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BIBLIOGRAPHY ON DISPOSAL OF REFUSE FROM COAL MINES AND COAL CLEANING PLANTS

Compiled by

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This study was conducted
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Office of Research and Development
U.S. Environmental Agency
Cincinnati, Ohio 45268

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The subjects covered in this bibliography include the analysis and characterization of coal refuse; various methods of handling, storing, and disposing of coal refuse; the environmental problems such as refuse drainage quality and combustion of refuse piles; the control of environmental problems; and the uses for refuse which have been investigated. The coal cleaning process itself is very closely related to the general subject area covered in this bibliography. However, the large number of publications available on coal cleaning have not been included unless they contained information that contributed significantly to the knowledge and understanding of coal refuse and its related disposal problems.

In addition to the abstracts, this volume includes an Author Index and a General Index, described in the section "The Bibliography, Its Format and Use" beginning on page 103, and an update for each of the environmental bibliographies described above. Appendix I, "Coal and the Environment Abstract Series: Bibliography on Mined-Land Reclamation" lists on page 141 publications acquired by BCR since 1975. Appendix II "Coal and the Environment Abstract Series: Mine Drainage Bibliography," lists on page 169 publications acquired since 1976.

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FOREWORD

When energy and material resources are extracted, processed, converted, and used, the related pollutional impacts on our environment and even on our health often require that new and increasingly more efficient pollution control methods be used. The Industrial Environmental Research Laboratory-Cincinnati (IERL-CI) assists in developing and demonstrating new and improved methodologies that will meet these needs both efficiently and economically.

The Coal and the Environment Abstract Series is a cooperative activity between Bituminous Coal Research, Inc. and the U. S. Environmental Protection Agency. This series is divided into three publications. The Mine Drainage Bibliography was published in 1976 and will be updated and published again in 1979. The Reclamation Bibliography will be published in October 1978. This publication is the Refuse from Coal Mines and Coal Cleaning Plants Bibliography. Each of the bibliographies contains an Appendix listing new material in the other two fields not given in the Bibliography. This volume brings together the first eleven issues into a single easier to handle volume. The subject areas of material listed in the bibliography cover surface and underground mines, active and abandoned mines, reclaimed surface mines, and planning of new mines. Also included are information on lakes formed by surface mining, drainage from coal refuse disposal areas, and water from coal preparation plants. A large number of items are concerned with effect of mine drainage on rivers and streams.

This volume should be a valuable reference source for anyone seeking information on coal research including the researcher, control agency, 208 planner, industrial planner and preparer of environmental impact studies. For further information contact the Resource Extraction and Handling Division.

David G. Stephan
Director
Industrial Environmental Research Laboratory
Cincinnati

PREFACE

To satisfy our nation's energy requirements, the mining of coal will increase steadily for the next 30 to 50 years. This increased coal production is being marked by the opening of numerous new mines, many of which are located in areas where mining has not existed previously. Obviously, there is and will be increased opportunity for the occurrence of environmental degradation resulting from coal mining. However, degradation need not occur if the existing and evolving abatement technology is well known and properly applied.

Numerous public and private efforts have contributed to the knowledge concerning coal's environmental problems and to their control. This knowledge is well documented, and BCR has been extensively involved in compiling and disseminating it. One facet of this acitivity has been the establishment of environmental libraries at BCR for use by the public as well as the coal industry, and the publication of bibliographies of abstracts based on these collections.

This volume is the second to appear in the "Coal and Environment Abstract Series" and the third environmentally related volume of abstracts prepared by BCR. In 1975, BCR compiled "Reclamation of Coal Mined-Land: A Bibliography with Abstracts" which was published by the National Coal Association. "Coal and the Environment Abstract Series: Mine Drainage Bibliography 1910-1976" was prepared in 1976 by BCR with co-sponsorship of the Pennsylvania Department of Environmental Resources and the United States Environmental Protection Agency. Copies of the Mine Drainage Bibliography can be obtained from BCR or from NTIS as PB-265 041/4 BE.

In 1973, BCR established a special collection of literature on refuse generated by coal mining and by coal cleaning plants. The publication is based substantially on that collection, which contains material dating back to the early part of the century.

The subjects covered in this bibliography include the analysis and characterization of coal refuse; various methods of handling, storing, and disposing of coal refuse; the environmental problems such as refuse drainage quality and combustion of refuse piles; the control of environmental problems; and the uses for refuse which have been investigated. The coal cleaning process itself is very closely related to the general subject area covered in this bibliography. However, the large number of publications available on coal cleaning have not been included unless they contained information that contributed significantly to the knowledge and understanding of coal refuse and its related disposal problems.

In addition to the abstracts, this volume includes an Author Index and a General Index, described in the section "The Bibliography, Its Format and Use" beginning on page 103, and an update for each of the environmental bibliographies described above. Appendix I, "Coal and the Environment Abstract Series: Bibliography on Mined-Land Reclamation" lists on page 141 publications acquired by BCR since 1975. Appendix II, "Coal and the Environment Abstract Series: Mine Drainage Bibliography," lists on page 169 publications acquired since 1976.

Much of the literature abstracted here is available from large libraries, government agencies issuing particular reports, or from the authors. Complete citations have been given so that the reader can obtain material from these sources. Items with NTIS numbers at the end of the citation may be purchased from U.S. Department of Commerce, National Technical Information Service, 5285 Port Royal Road, Springfield, Virginia 22161. For those who have difficulty in obtaining material from these sources, arrangements can be made to use the collection at the BCR library on weekdays between 8:00 a.m. and 4:30 p.m. Limited interlibrary loan service and photocopies of non-copyright material for a nominal fee are also available. Please direct requests to Librarian, Bituminous Coal Research, Inc., 350 Hochberg Road, Monroeville, Pennsylvania 15146.

Searching for and acquisition of information on coal mining and cleaning plant refuse is a continuing project. Coverage of the early literature is essentially complete. However, we recognize that, particularly for the most recent years, some material may not have come to our attention. We would appreciate receiving copies of any publications not listed here. Abstracts of previously unlisted material as well as of new publications will be included in future issues of the Bibliography. Any other suggestions, comments, or criticism of this publication are welcomed.

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Appendix II, COAL AND THE ENVIRONMENT ABSTRACT SERIES: MINE DRAINAGE BIBLIOGRAPHY (Alphabetical listing updating 1976 bibliography)...................................... 169

FORMAT AND USE OF THE BIBLIOGRAPHY

The abstracts are grouped according to the year of publication with each section being headed by its chronological designation. Within each group abstracts are arranged alphabetically by the first author or, if none, by title. Each abstract is numbered sequentially within the year of publication so that it has its own unique number: for example, D73-27. The letter D indicates the general subject area of the disposal of coal mining and coal cleaning plant refuse. The next two digits refer to the year of publication. The number to the right of the hyphen indicates the order in which that abstract is listed within the publication year. These unique numbers are used to reference the abstracts in the indexes. Only one entry does not follow this rule exactly. The number for an 1893 publication has been given the abstract number D00-1 to make it obvious that it is the first entry and not the last, as the designation "D93-1" might have indicated. At the end of each abstract are either letters, numbers, or various letter-number combinations. These are related to the filing of the material in the BCR library, and will aid the BCR staff in answering questions on the availability of the material.

The Author Index includes the names of all persons who have been listed as authors or editors of any publication. When the organization is shown as the author, it is listed in the General Index. Names beginning with Mc or Mac have been included alphabetically, as spelled, and are not grouped together.

The General Index includes the following categories: names of industry, government, and academic organizations engaged in or sponsoring work relating to coal refuse disposal; geographic features such as names of foreign countries, of states and regions of the United States, and of rivers; and subject area topics such as characterization of refuse and refuse disposal, which are indicated by terminology which is as specific as possible. For instance, Federal government agencies are listed by name and are not grouped together under United States. As an example, Geological Survey is an entry under "G" listings and is identified as being part of the U.S. Department of Interior. State agencies are indexed using the name of the state as the initial word of the agency title, thus Pennsylvania Topographic and Geologic Survey. Also, subordinate parts of government agencies are used as main index entries, with cross references from the parent organization. The Crown, West Virginia, Mine Drainage Control Field Site is a main entry and also is included in the list to "See" under Environmental Protection Agency, U.S. Government. In all categories, cross-references and supplemental words and phrases are used liberally to facilitate information retrieval. All entries are intermixed in strictly alphabetical order which follows the word-by-word method, with hyphenated words considered as one word.

The updates of the two previously published environmentally related bibliographies, described in the Preface, appear after the indexes. Publications are listed alphabetically by author or title in each category, coal mine drainage and surface-mined land reclamation. There are no abstracts for these items nor are they indexed. However, they will be included in the subsequent abstract bibliographies planned for each subject area.

1893

D00-1 REPORT OF COMMISSION APPOINTED TO INVESTIGATE THE WASTE OF COAL MINING WITH THE VIEW TO THE UTILIZING OF THE WASTE

Coxe, E. B., Thompson, H. S., and Griffith, W. (Commission, Commonwealth of Pennsylvania), Philadelphia: Allen, Lane & Scott's Printing House, May 1893, 183 pp.+ A number of uses of waste as fuel are discussed. They include use in gas producers and manufacturing coke. The report also includes a list of literature on the subject. The Pennsylvania State Library PYC 6529. 1

1913

D13-1 HYDRAULIC MINE FILLING: ITS USE IN THE PENNSYLVANIA ANTHRACITE FIELDS: A PRELIMINARY REPORT

Enzian, C., U.S. Bur. Mines, Bull. 60 (1913). 77 pp. Coal mining and preparation waste is one of the filling materials discussed. Also considered in the report are surface and underground methods of conveying the filler, types of areas to be filled and bulkheads to contain the fill, and the effects of hydraulic filling on mine ventilation and drainage. D237

1922

D22-1 PYRITE FROM BITUMINOUS COAL MINES IN PENNSYLVANIA

Leighton, H., Pa. Geol. Surv. Bull. No. 48 (1922). 19 pp. The results of a survey to determine the areas in which pyrite occurred is reported. The various modes of occurrence of the mineral with the coal are also described. The purpose of the study was to evaluate the feasibility of recovering pyrite as a raw material for the production of sulfur and sulfuric acid. PaGeol

1928

D28-1 ANTHRACITE CULM AND SILT

Sisler, J. D., Fraser, T., and Ashmead, D. C., Pa. Topographic Geol. Surv., Bull. M 12 (1928). 259 pp. The survey of the anthracite coal fields of northeastern Pennsylvania records the occurrence and character of silt and culm deposits. The use of silt and culm in manufactured anthracite fuels is described. The investigation of stream conditions in the area includes listing the method of disposal of breaker water by coal producers. A number used settling basins but some discharged water directly into the stream. PaGeol

1929

D29-1 THE ROLE OF STRATIFICATION IN THE SEPARATION OF COAL AND REFUSE ON A COAL-WASHING TABLE

Bird, B. M., and Davis, H. S., U.S. Bur. Mines, RI 2950 (1929). 19 pp.

D29-1 (continued)

A riffle table and two sizes of coal, 4 mesh and plus 20 mesh, were used to study the process whereby coal particles are separated from refuse. Details of the tests are given and the stratification is described. The object of the tests was to show that stratification, contrary to common belief, will not account for the separation effected by the coal washing table. Only enough water to maintain mobility should be used to give desirable action of the washing table. BurM

D29-2 UTILISATION OF COLLIERY PIT-BANKS

Thomson, P. M., The Scottish Forestry J. 43, 46-48 (1929). In February 1924 and again in September 1928, plantings which had been made in 1912 at Allhallows Pit, Cumberland, England were surveyed. Results showed that of eleven species planted as seeds or seedlings larch, Scots pine, and Sitka spruce could be grown on refuse. D326

1931

D31-1 PNEUMATIC STOWAGE MAKES RAPID STRIDES IN MINES OF GERMANY

Dierks, H. A., Coal Age 36, 466-468 (1931). Both high and low pressure systems are described. Coal washery refuse is one of the materials that can be used. Jour

D31-2 REFUSE DISPOSAL SYSTEM: CONTROLLED BY TOPOGRAPHY AND MAXIMUM CAPACITY DEMANDS

Coal Age 36, 630-632 (1931). The design of the refuse disposal area and the use of various types of refuse conveyers are discussed. Jour

D31-3 RE-TREATMENT OF SAYRETON JIG MIDDLINGS ON COAL-WASHING TABLES

Richardson, A. C. and Gandrud, B. W., U.S. Bur. Mines, RI 3101 (1931). 6 pp. Bureau of Mines and University of Alabama cooperating with different coal operators made an extensive study of coal preparation in Alabama. Considerable time was devoted to washing characteristics of the Mary-Lee bed and the various methods used to prepare a low-ash coal suitable for making metallurgical coke. One phase devoted time in using middlings products from washing plants. BurM

1934

D34-1 METHOD AND APPARATUS FOR FEEDING AND SEPARATING DRY COAL FROM REFUSE

O'Toole, E., Sr., U.S. Pat. 1,950,861 (March 13, 1934). 8 pp. The patent describes a vibrating table with riffles and with perforations which allow air flow to separate the coal from the heavier refuse.

1936

D36-1 POSSIBLE RECOVERY OF COAL FROM WASTE AT ILLINOIS MINES

Smith, C. M. and Mitchell, D. R., Univ. Ill., Eng. Expt. Sta., Bull. No. 285 (1936). 44 pp. To test the feasibility of recovering coal and other products, large samples of cleaning refuse were taken at 12 mines. Each sample was crushed, sized, and float-sink tested in the laboratory with results which indicate that in general about one-third of the material now rejected could be profitably recovered as marketable coal. CE46

1939

D39-1 THE PLANTING OF TIPS AND SLAG HEAPS

James, N. D. G., Quart. J. Forest. 33, 164-172 (1939). Colliery waste is one of the types of waste materials considered. Species of trees successfully grown on burnt and on unburnt refuse are listed. D275

1940

D40-1 DARKENING LIGHT-COLOR SOILS WITH COAL-MINE WASTE

Broderick, S. J., U.S. Bur. Mines, RI 3516 (1940). 6 pp. This article explains the advantage of dark soil over light colored soil, i.e., its ability to retain a higher temperature level thus promoting growth at an earlier date. Work done showed the temperature difference to be as high as 9 degrees F. Coal dust also adds some fertilizing value to the soil. A section on effects of coal-mine waste on crops is included. BurM

D40-2 SOME INFORMATION ON EXTINGUISHING AN ANTHRACITE REFUSE BANK FIRE NEAR MAHANOY CITY, PA.

Leitch, R. D., U.S. Bur. Mines, IC 7140 (1940). 16 pp. The history of the refuse bank fire at the St. Nicholas Colliery of the Philadelphia & Reading Coal & Iron Co. is related. An unsuccessful attempt was made to extinguish the fire by applying a limestone slurry through a number of holes made in the bank. The fire was finally controlled by excavation and isolation of the burning refuse. The description of this work includes a tabulation of the nature and causes of injuries received on the job. BurM

D40-3 MINERAL WOOL FROM ANTHRACITE COLLIERY REFUSE AND ANTHRACITE ASHES

Rose, H. J. and Johnson, R. C. (Mellon Inst.), Trans. Third Ann. Anthracite Conf., Lehigh Univ., May 9-10, 1940. pp 45-54. This paper describes the work done by the authors in successfully preparing mineral wool from anthracite refuse and anthracite ashes. Pictures show the equipment used and the resulting product. Limestone is used as an additive and some fuel in the form of gas is needed. Steam can be used to control temperature. Economics given were favorable and there is no shortage of raw material. 662.6 A628

1941

D41-1 CARBONACEOUS CATION EXCHANGERS FROM COAL AND COAL REFUSE

Broderick, S. J. and Bogard, D., U.S. Bur. Mines, RI 3559 (1941). 17 pp. Results showed that the use of Alabama bituminous-coal-mine waste as a raw material for making a granular water-softening product does not seem feasible because of the high loss of fines resulting from the activation treatment. However both the clay and the coal fractions of the refuse showed distinct base-exchange properties. The clay portion of the refuse was activated into a base-exchange product by alkali, whereas coal was activated into a hydrogen exchanger by concentrated H_2SO_4. However, the coal was a more active cation exchanger than the clay for water-softening purposes, so it is preferable to develop the activating procedure around coal. (From authors' Summary) D243

D41-2 ACTIVATED CARBON FROM COAL REFUSE FOR WATER PURIFICATION

Broderick, S. J. and Hertzog, E. S., U.S. Bur. Mines, RI 3548 (1941). 27 pp. This work was done on refuse from the Colta mine, Mary Lee bed and from the Corona mine, Corona bed, both in Walker County, Alabama. Results showed that high carbon fractions could be activated readily by steam and by zinc chloride and that high ash content of refuse not only acted as an inert but also reduced the activity of the carbon. D244

1943

D43-1 POWER SALVAGED BY PROPERLY USING OTHERWISE WASTE COAL

Richart, F. W., Coal Age 48 (8), 65-69 (1943). This article reports the varying methods, problems, and successes in using fine coal, both dust and slurry, for power generation by Antioch Power Co., Linton, Ind., by Central State Collieries, Canton, Ill., Chicago, Wilmington & Franklin Coal Co. at its Orient No. 1 Mine, Orient, Ill., and by the Princeton Mining Co., Princeton, Ind. Jour

1944

D44-1 PRECISION JIGGING AS A SUBSTITUTE FOR A LABORATORY SINK-FLOAT

Coe, G. D. and Coghill, W. H., U.S. Bur. Mines, RI 3769 (1944). 7 pp. This paper describes a method for sorting of particles by means of a laboratory batch jig. The purpose is to show that a material can be reliably appraised for gravity concentration without the drudgery of sink-float fractionations. BurM

D44-2 SALVAGE OF COAL FROM MINE REFUSE IN THE PITTSBURGH DISTRICT

Fraser, T., Kelley, J. A., and Graham, H. G., U.S. Bur. Mines, RI 3768 (1944). 23 pp. This report describes a study of available coal in mine refuse in the Pittsburgh District of Western Pennsylvania. Information included gives details on a number of refuse areas. Many samples were

D44-2 (continued)

collected and used for washability studies also shown in this report. Considerable discussion is given on ways to recover usable coal from the many refuse areas. BurM

D44-3 PRECLEANER MATERIALLY INCREASES WASHER OUTPUT

Coal Age 49 (6), 78-80 (1944). Gilberton Coal Company, Gilberton, Pa. reclaimed anthracite coal by feeding refuse from an old bank to a shaker and a roughing jig which removed the higher gravity material before it went to the preparation plant. Refuse from the preparation plant also goes through the precleaner. Final coal product can have as low as 9 percent ash. Jour

D44-4 ESTABLISHMENT OF VEGETATION ON COAL TIPS AND OTHER SPOIL MOUNDS

Sisam, J. W. B. and Whyte, R. O., Nature 154 (3912), 506-508 (1944). Before the areas are planted, information should be obtained on the degree of weathering of the material, on the nutrient or toxic status, and on soil moisture and tip drainage. On poor material, or if topsoil is not spread, grasses or trees that have low fertility requirements and that will add humus to the soil are suggested for initial plantings. Specific tree planting techniques are discussed. D279

1945

D45-1 LARRY TRAIN SOLVES OAK HILL REFUSE-DISPOSAL PROBLEM

Richart, R. R., Coal Age 50 (11), 103-108 (1945). Philadelphia & Reading Coal and Iron Co. in Minersville, Pa. used a four car larry train on grades up to 10 percent to haul refuse higher on the dumping area. The electrical system used to power the train is described in detail. Jour

1947

D47-1 EFFECTS OF STOWING ON SURFACE SUBSIDENCE

Trans. Inst. Mining Eng. 107, 58-61 (1947-1948). Pneumatic and hydraulic stowing of coal refuse material to prevent surface subsidence are discussed. Some experience at British mines is included. D253

D47-2 WASHER RECLAIMS BANK COAL

Coal Age 52 (8), 92-93 (1947). At the Six K Coal Corp., Clarksburg, W. Va. refuse with 30 percent coal is fed to a washer-conveyer. Calcium chloride, or other media, is used to float the coal which is continuously removed by the conveyer and dewatered. Jour

1948

D48-1 BURNING REFUSE DUMPS AT COAL MINES

Harrington, D. and East, J. H., Jr., U.S. Bur. Mines, IC 7439 (1948). 28 pp. This publication discusses all phases of refuse dumps including combustible material, causes of fire, products of combustion, methods of constructing refuse dumps, examples of refuse dump fires, and fatal accidents at burning refuse dumps. A number of recommendations are given for extinguishing burning refuse dumps. BurM

1949

D49-1 BRUSHING WITH ROOM STOWAGE

Coal Age 54 (9), 82-83 (1949). To provide clearance for cars, the Williams Coal Co., Mannington, Ky. removes either top or, preferably, the bottom of the 42 inch seam and places rock material in specially driven rooms. The work of the 5-man crew is described. Jour

1950

D50-1 MINE REFUSE DISPOSAL

Cuthbert, W. R., Hanson, V. D., Perkins, G. N., and Vogel, L. J., "A report by a surface preparation sub-committee of the AMC Coal Division," Mining Congr. J. 36 (1), 43-46 (1950). Merle, J. J., Hicks, H. N., Caler, W. R., and Weber, D. A., "Washery disposal at strip mines," Mining Congr. J. 36 (1), 46-47 (1950). Various methods of handling refuse under different conditions are described. D158

D50-2 RECOVERING SLUDGE AT HARCO

Coal Age 55 (9), 84-87 (1950). Peabody Coal Company at its Harco mine in Harrisburg, Illinois reclaimed its sludge pond material at the rate of 250 tons/shift. The 28m x 0 coal is sold for pulverized fuel. The two ponds used in turn are allowed to drain before material is taken to the drying plant. Dried coal is discharged continuously while sludge is being fed to the dryer. When cars are loaded, 18 gallons of heavy base oil at between 120 and 150 F are sprayed over the coal thus waterproofing it and preventing transit loss. D162

1951

D51-1 HYDRAULIC STOWING IN PENNSYLVANIA

Colliery Eng. 28 (329), 281 (1951). Three case histories reported by H. Merton Ruth, Division Superintendent, Glen Alden Coal Company, Wilkes-Barre are of pillar recovery and control of surface subsidence with mechanical stowage or hydraulic stowing of mining and preparation plant refuse. D231

D51-2 PROCESSING TAILINGS INTO LIGHTWEIGHT AGGREGATES

Lenhart, W. B., Rock Products 54, 94-95, 107-108 (Sept. 1951). The Lehigh Materials Co. made lightweight aggregate by vitrifying anthracite refuse on a travelling grate. The continuous ribbon of molten product is cooled and crushed and meets A.S.T.M. specifications for use in concrete. Details of the process and equipment are given. D273

D51-3 NO GOB FIRES . . . MORE GOODWILL

Coal Age 56 (5), 91-93 (1951). Christopher Coal Div. of Consol extinguished its burning refuse piles near Morgantown, W. Va. by smoothing the piles with dirt and stepping, trenching, and earth-filling as needed. The method of building and compacting new piles to prevent burning is described. D163

D51-4 SOME GERMAN EXPERIMENTS IN THE GASIFICATION OF WASHERY REJECTS AND PULVERIZED FUEL

Natl. Coal Bd., Production Dept., Inform. Bull. No. EG (51) 9. (undated). 6 pp.+ This bulletin outlines the attempts which have been made in Germany (in World War II) to find an economical process for gasifying rejects from washeries. (From text) D187

D51-5 STONE PREPARATION FOR POWER STOWING

Natl. Coal Bd., Production Dept., Inform. Bull. No. MM (51) 8, (undated). 6 pp.+ Materials referred to in this publication include washery dirt, pit dirt, screen pickings and tip dirt. In each case some preparation for both mechanical and pneumatic stowing is required. Restrictions for mechanical stowing are far less rigid than those for pneumatic stowing. Designs for crushing and stone preparation plants are included in diagrammatic form and there are comments on various crushers and other handling equipment. D186

D51-6 PRESSURE-DROP IN PNEUMATIC STOWING PIPE-LINES

Whetton, J. T. and Broadhurst, P. H., Trans. Inst. Mining Eng. 111, 920-936 (1951-1952). Further discussion of the paper, Trans. Inst. Mining Eng. 112, 352-354 (1952-1953). While the paper is mainly concerned with analysis of pressure drop, particle motion, conveying air velocity, and the effect of pipe bends are also discussed. D195-6

1952

D52-1 A PROPOSED SEALED CIRCULAR COAL-REFUSE PILE

Nelson, W. L. and Hall, E. P., Mechanization 16 (12), 85-89 (1952). Plan and elevation views of a proposed circular coal-refuse pile are shown indicating constructional features including the permanent clay seal and the access road. Pile is built at 2 ft layers compacted with a clay seal on the wall of each 3 layers. Each wall is set back from the underlying

D52-1 (continued)

wall to reduce erosion. Pile also has a road of crushed rock built into it. A table contains calculated volumes and costs of sealed circular coal refuse piles. D101

D52-2 POWER STOWING OF RIPPING DIRT

Natl. Coal Bd., Production Dept., Inform. Bull. No. 52/67 (undated). 7 pp. This publication describes an underground method for handling coal refuse mechanically. The system uses a scraper bucket which is moved in two directions by an assembly of ropes. A diagrammatic sketch illustrates how the material is moved. Emphasis is on the labor saving features of the method and labor requirements. Power needs are given. D188

1953

D53-1 DIRT DISPOSAL BY DUMP TRUCK

Natl. Coal Bd., Production Dept., Inform. Bull. No. 53/100 (undated). 6 pp.+ This British publication refers to the problem of covering coal refuse at the time of mining to make the land usable for other purposes. The discussion concerns trucks most suitable to do this. A number of truck sizes and the economics involved are discussed. D178

D53-2 STREAM POLLUTION BY COAL MINE WASTES

Hebley, H. F., Trans. AIME 196, 404-412 (1953). This paper is a general description of the nation's water resources. It touches on the phenomenal growth in demand for water supply and emphasizes the problems facing the coal industry both with regard to acid mine water drainage discharged from active and abandoned mines and the suspended solids discharged to the stream system from wet coal preparation plants. 53-9

D53-3 WASTE DISPOSAL PROBLEMS IN THE COAL MINING INDUSTRY

Hodge, W. W. (Mellon Inst.), in "Industrial Wastes," W. Rudolfs, Ed., New York: Rheinhold Publishing Corp., 1953. pp 312-418. Coal refuse handling and storage and attendant problems are discussed in detail. 628.2 R917

D53-4 AFFORESTATION OF INDUSTRIAL WASTE LANDS

James, N. D. G., Quart. J. Forest. 47, 170-179 (1953). Colliery waste is one of the several types of industrial waste considered. Various tree species recommended for this waste are noted, as are several refuse heaps which had been planted a number of years previously. D278

D53-5 ANTHRACITE MECHANICAL MINING INVESTIGATIONS PROGRESS REPORT 6; PRELIMINARY TESTING OF BRIEDEN PNEUMATIC PACKING MACHINE

Landsidle, C. A., Hartley, J. C., and Buch, J. W., U.S. Bur. Mines, RI 4978 (1953). 13 pp. Although the emphasis in this report is on the packing

D53-5 (continued)

machine and its operation, the preparation plant refuse used for packing is described. It was noted that anthracite refuse appeared to be ideal for pneumatic packing and no serious trouble was experienced from the fines. BurM

1954

D54-1 HOW TO STOP POLLUTION

Gilbert, A. G. (Heyl & Patterson, Inc.), Coal Age 59 (12), 62-65 (1954). Cyclones, with vibrators, filters and centrifuges; two-stage thickening; flocculation, froth flotation, and settling ponds are all in use to clarify water from coal preparation plants and at the same time recover coal. The application of various combinations of these methods in closed systems and in open circuits is discussed. Jour

D54-2 FINAL SUMMARY REPORT OF WESTERN PENNSYLVANIA COAL OPERATORS ASSOCIATION INDUSTRIAL FELLOWSHIP NOS. 1, 2, 3, 4, AND 5, JAN. 1949 TO MAY 1954

Nelson, W. L., Mellon Inst., Fellowship No. 336, 1954. 82 pp. Objects of the work under these fellowships was to investigate fundamental aspects of spontaneous heating of coal refuse piles and to develop practical methods of preventing and extinguishing refuse fires. A limited number of tests have been made on actual refuse sites. 54-34

D54-3 SOME OBSERVATIONS ON TRIALS WITH DUMP TRUCKS (SUPPLEMENT TO INFORM. BULL. 53/100)

Natl. Coal Bd., Production Dept., Inform. Bull. No. 54/112 (undated). 7 pp.+ The economics of using several types of dump trucks in coal refuse disposal are evaluated. The trials were carried out under conditions devised to simulate the most adverse situations that might be encountered. D179

1955

D55-1 CONVERSION INTO AGGREGATE: ANSWER TO REFUSE PROBLEM

Coal Age 60 (11), 78-81 (1955). Trulite Corp. at Ceredo, W. Va. was founded to relieve the refuse disposal problem of Truax-Traer Coal Company. Since the raw refuse contained 40 to 50 percent combustible, mainly carbonaceous shale, a combustion system was developed to prepare the aggregate. The process and equipment are described. Jour

D55-2 RECOVERY OF COAL FROM WASHERY REFUSE: SOME EXAMPLES OF THE EFFECT OF CONTINUOUS MINING MACHINES ON PREPARATION PROBLEMS

Geer, M. R., Fennessy, F. D., and Yancey, H. F., U.S. Bur. Mines, RI 5152 (1955). 45 pp. Cleaning trials were made on three samples of jig refuse

D55-2 (continued)

in a dense-medium pilot plant to demonstrate the application of this process to the recovery of coal from waste. These tests showed that coal could be separated from impurity with the same degree of sharpness obtained in treating raw coal by dense-medium. It may be economically feasible to re-treat all or a portion of the washery refuse to recover the coal lost in the primary cleaning units. Dense-medium process is especially attractive for re-treating refuse because of the inherent sharpness with which it can separate coal from impurity. (From authors' Summary and Introduction) BurM

D55-3 USE OF PULVERIZED ROCK AS DENSE MEDIUM FOR SALVAGING COAL FROM PITTSBURGH-BED REFUSE

Palowitch, E. R., Jolley, T. R., and Sokaski, M., U.S. Bur. Mines, RI 5184 (1955). 33 pp. This investigation dealt with the mechanical recovery of coal from mine refuse by a dense-medium washery employing pulverized mine rock as the dense medium and operating at the rate of 175 tons per hour. The two types of mine refuse tested were freshly mined refuse and refuse mined two years before and piled on a waste dump. Feed to the washbox and clean coal and refuse products from the washing operation were sampled and the samples were evaluated to calculate the recovery efficiency. With the weathered mine refuse, recovery was 27.5 percent clean coal which analyzed 8.5 percent ash and 1.47 percent sulfur. The freshly mined refuse yielded 20.8 percent clean coal which analyzed 8.1 percent ash and 1.83 percent sulfur. (From authors' summary) BurM

D55-4 RECOVERING RIVER COAL

Coal Age 60 (5), 78-83 (1955). Pennsylvania Water & Power Co. coal recovery plant at Safe Harbor, Pa. on the Susquehanna River is described. Refuse and effluent from washing and dewatering operations are disposed of in a basin built by damming a valley in the area. Sandy refuse from flotation and tabling is used to increase the height of the dam. Slimes from the clarifier and effluent from the dewatering process are sent to the main settling basin. A concrete runoff pipe laid under the dam carries off clarified water drawn from the top of the pool through a stand pipe. Jour

1956

D56-1 CRUSHING STOWING MATERIAL

Colliery Eng. 33 (388), 264 (1956). This abstract of a German article shows two views of a crushing plant installed at Ickern Colliery in the Ruhr to handle washery discard and picked refuse from its own operation and additional dirt from other collieries, all of which was required for stowing. D249

D56-2 THE CONTROL OF GOB PILE FIRES

Hebley, H. F., J. Air Pollut. Contr. Assoc. 6 (1), 29-31, 51 (1956). The cause of refuse pile combustion is discussed and methods of construction to prevent burning are described. D192

D56-3 LOW-COST BANK RECLAMATION

Coal Age 61 (11), 72-75 (1956). The Black Star Anthracite Co. of Hazelton, Pa. processes 2250 tons/day via heavy media to recover coal from culm bank material. Recovery averages 7 to 12 percent. Jour

D56-4 DENSE-MEDIUM PILOT-PLANT PERFORMANCE TESTS ON COAL

Palowitch, E. R., Sokaski, M., and Jolley, T. R., U.S. Bur. Mines, RI 5212 (1956). 52 pp. This report is the result of a series of coal-cleaning tests using a dense-medium cone-type washer. Detailed results are given for two tests using magnetite medium and four tests using a pulverized-refuse medium. BurM

D56-5 THE DISPOSAL OF COAL REFUSE: TECHNICAL COORDINATING COMMITTEE T-4 COAL REPORT

Rose, H. C., Corey, R. C., Engdahl, R. B., Foster, J. J., and Garvey, J. R., J. Air Pollut. Contr. Assoc. 6 (2), 105-110 (1956). This report describes spontaneous heating in refuse piles and gives directions for construction methods to prevent ignition and burning. D193

D56-6 ANTHRACITE MECHANICAL MINING INVESTIGATIONS, SECOND TESTING OF BRIEDEN PNEUMATIC PACKING MACHINE

Whaite, R. H., U.S. Bur. Mines, RI 5273 (1956). 22 pp. A pneumatic packing machine from Germany, installed in a mine in the anthracite region of Pennsylvania, was used to stow 3" x 0 refuse. Although the project showed that refuse could be packed in this way, pillars were not removed so the effectiveness against subsidence could not be evaluated. BurM

1957

D57-1 AUTOMATIC REFUSE PUMPING

Coal Age 62 (11), 72-73 (1957). An automatic variable-speed-control pumping installation which conveys variable loads of coal washery water to a settling pond about 350 ft above and 1300 ft away from the preparation plant is used by the Red Parrot Coal Co., Div. of North American Coal Corp. in Prenter, W. Va. Jour

D57-2 BIG-VOLUME REFUSE DISPOSAL AT VESTA-SHANNOPIN PLANT

Coal Age 62 (7), 76-79 (1957). The refuse handling system at the Jones & Laughlin plant includes a combination stationary and portable belt conveyer

D57-2 (continued)

and a moveable stacker which distributes the refuse in a preplanned pattern in the disposal area. The details of the system and some experiences in the first several years of operation are described. Jour

D57-3 THE ECOLOGY OF DISUSED PIT HEAPS IN ENGLAND

Hall, I. G., J. Ecology 45, 689-720 (1957). In this survey carried out in 1952, more than one hundred sites were visited. All species found on the refuse piles are listed. The types of plants found were related to the age of the refuse pile, with trees and woody plants on the oldest and a distinctive pioneer herb-grass community on the youngest. Differences between vegetation on burnt and unburnt refuse were also identified and discussed. D327

D57-4 HOW Y & O CONTROLS STREAM POLLUTION

Coal Age 62 (11), 84-86 (1957). The Youghiogheny and Ohio Coal Co. at Van, W. Va. built settling ponds on top of their refuse banks. Solids settle out and water draining through the bank and entering streams can meet West Virginia Water Control Commission standards. The pond area and pumping facilities are described. Jour

1958

D58-1 METHODS OF UTILIZING SHALE FROM DIRT HEAPS

Brison, L. and Moiset, P., Third Int. Coal Prep. Conf., English Text, Ann. Mines Belg., 1958. pp 641-644. The processing of coal refuse to give cleaned coals, with varying ash content, and material for use in pneumatic stowing is described. 662.6 I927

D58-2 PHANTOM PRODUCT - - - MINE WASTE

Charmbury, H. B., Mechanization 22 (5), 46-52 (1958). The nature and extremely large amount of refuse from coal mining and coal cleaning and various methods of handling and disposing of this refuse are discussed. D272

D58-3 70-YD KING OF SPADES: PACESETTER AT NEW RIVER KING

Flowers, A. E., Coal Age 63 (1), 76-87 (1958). There is a short description of the refuse handling method at the coal cleaning plant at Peabody Coal Company's River King mine near Freeburg, Ill. Clarified overflow from the settling pond goes into the plant's fresh water supply so that no plant water goes into the outside stream drainage. Jour

D58-4 THE EFFECT OF TEMPERATURE ON THE GROWTH OF PLANTS ON PIT HEAPS

Richardson, J. A., J. Ecol. 46 (3), 537-545 (Nov. 1958). Because of the composition and slope of pit heaps high temperatures may persist in the

D58-4 (continued)

surface layer for several hours daily in the summer. Temperature records from observations made at Ouston, County Durham, show the ameliorating effect of the presence of colonizing species. The rate at which pioneer species become established appears to be accelerated by the presence of a moss-lichen layer. (From author's Summary) D307

D58-5 GOOD PREPARATION DESIGN

Zacher, F. R. (Christopher Coal Co.), Coal Age 63 (3), 100-103 (1958). A general discussion of plant refuse handling and disposal is included as one of the considerations in preparation plant design. Jour

1959

D59-1 REFUSE FOR DENSE-MEDIUM CLEANING

Walter, L., Mechanization 23 (10), 71-73 (1959). At "Manvers Main" Central Coal Preparation Plant, the output of four collieries mining five different coal beds is treated in three almost identical parallel coal cleaning systems. Reject from the froth flotation is used to provide the dense medium in the baths. Details of the cleaning process, including control of specific gravity, and descriptions of the cleaned coals are given. D268

1960

D60-1 GASIFICATION OF BONE ANTHRACITE

Eckerd, J. W., Clendenin, J. D., Sanner, W. S., and Morgan, R. E., U.S. Bur. Mines, RI 5594 (1960). 24 pp. The Wellman-Galusha standard gas producer was used to gasify bone anthracite. The results showed that for high ash coals the equipment would need considerable modifications since fuel bed conditions could not be stabilized. Clinkers formed and uniform air distribution was never satisfactorily maintained. BurM

1961

D61-1 AUTOMATED ANTHRACITE PROCESS SAVES WASTE

Metallurgia 64, 238 (Nov. 1961). Magnetite is used as the dense medium in the process that allows recovery of fine coal from refuse and produces cleaned coal with a uniform ash content. Because of the high rate of recovery of the dense medium only 0.4 lb per ton of raw coal is needed. D266

D61-2 AUTOMATIC REFUSE DISPOSAL

Coal Age 66 (3), 86-87 (1961). An automatic aerial tramway, carrying 70 tph to a refuse disposal area is described. The tramway is used instead of building a roadway in the mountainous area. Jour

D61-3 LOW PRESSURE STOWING WITH A SCREW COMPRESSOR

Mining J. 256, 332-333 (Mar. 24, 1961). The experience of the National Coal Board with low pressure stowing is described and the advantages of a screw compressor are pointed out. D285

D61-4 THE PERMEABILITY OF HYDRAULIC FILL MATERIALS

Mickle, D. G., Jr., The Pa. State Univ., M.S. Thesis, 1961. 42 pp. This study was concerned with the effect of particle size on the permeability of hydraulic mine fills. As far as possible other variables were kept constant. Laboratory investigations were carried out with samples of coal-washer refuse, sand, mill tailings, boiler ashes, and glass spheres. Permeability was determined both for narrow size ranges and for samples containing several size ranges in various proportions. Predicted permeabilities were found to be fairly accurate for samples with permeabilities below 6 inches per hour. The error for values above this permeability was believed to be caused by departure from laminar flow. Permeability of fine-grained materials could be predicted with satisfactory accuracy. D242

D61-5 PERMEABILITY AND COMPRESSIBILITY TESTS AID IN SELECTING SUITABLE HYDRAULIC FILL MATERIALS

Mickle, D. G. and Hartman, H. L., Mining Eng. 13, 1246-1248 (1961). This paper describes test work done on five sizes of coal washer refuse to evaluate their performance as hydraulic fill materials and give compressibility and permeability data. All materials obtained in the anthracite region had suitable permeability. Jour

D61-6 PREPARATION OF PIT STONE FOR STOWAGE

Colliery Eng. 38, 332-335 (1961). The article describes the plant for preparing crushed, graded stone from mining waste for stowing underground at Glyncorrwg Colliery, Glamorganshire, Wales. D211

1962

D62-1 IMPROVEMENTS IN OR RELATING TO THE UTILIZATION OF WASTE MATERIAL

Becker, F., Kulcsar, I. G. G., Palotai, L., and Reviczky, F. (to Nikex Nehezipari Kulkereskedelmi Vallalat), Brit. Pat. 913,177 (Dec. 19, 1962). 4 pp. Coal mine waste is processed by crushing, suspending it in water, and passing the slurry through a hydrocyclone to obtain coal-rich and coal-poor fractions. Density of the suspension is controlled and the size consist of the material is kept within specified limits. Examples are given of coal-poor fractions used in brick manufacture and mine filling. D194

D62-2 CRUSHER STOWING

Cadman, W. B. and Weston, G., Mining Engineer 121, 809-821 (1962). Experience in low-pressure stowing at three mines in the United Kingdom is

D62-2 (continued)

discussed. Equipment developed by Markham & Company, Ltd. was used in the mines for crushing material produced in mining and for returning it directly to the area to be packed. This process resulted in better face conditions, reduction in damage due to subsidence, and the ability to continue faces under built up areas. D213

D62-3 PELLETIZING PROCESS RECOVERS MARKETABLE COAL FROM SLURRY

Charmbury, H. B., Coal Utilization 16 (9), 19-22 (1962). Coal pellets were prepared from the slurry overflow from settling tanks for clean coal. It was estimated that 300 to 500 tons per day of marketable product was recovered. 440.3 62-1

D62-4 COAL FINES ARE SUCCESSFULLY PELLETIZED

Coal Age 67 (11), 125 (1962). Dravo Corp. at its research center pelletizes coal fines using a lignosulfate paper mill waste and bentonite. The pellet can be handled and dries to an excellent strength. Filter cake material was also pelletized using the Dravo-Lurgi disks. Several companies now use the process commercially. Details of the pelletizing techniques are included. Jour

D62-5 PROCESSING AND DISPOSAL OF COAL FLOTATION TAILINGS

Dahlstrom, D. A., Mining Congr. J. 48 (3), 50-55 (1962). Methods of dewatering refuse from fine coal recovery operations are described in detail. D267

D62-6 COAL REFUSE FOR BUILDING MATERIALS

Edwards J. A., Colliery Guardian 205, 340-346 (1962). This article reviews the work of the U.S. Bureau of Mines with material from the Trulite Corp. which produced aggregate from refuse at a Truax-Traer mine in West Virginia and with refuse supplied by the Carbon Fuel Company, West Virginia. Results showed that characteristics of the refuse determined whether or not a satisfactory aggregate could be made with or without additives. The effects of varying conditions in the pelletizing furnace are discussed. D214

D62-7 FINE COAL RECOVERY AND MINE BACKFILL PREPARATION

Mechanization 26 (10), 30-34 (1962). Sunnyside Coal Mines of Kaiser Steel Corp. in Utah use flotation cells to recover fine coal. The refuse slurry, pumped back into the mines for roof support, is not deslimed since it was found that slime content had no detrimental effects and improved pumping characteristics. A detailed flowsheet of the coal recovery is included, and the process and equipment are described. D215

D62-8 AIR POLLUTION FROM COAL REFUSE PILES

Hall, E. P., Mining Congr. J. 48 (12), 37-41 (1962). Methods of extinguishing

D62-8 (continued)

fires in refuse piles and methods of handling refuse and constructing piles to prevent combustion are discussed. D256

D62-9 INVESTIGATIONS ON THE OPERATION OF THE CIRCULAR CONCENTRATOR FOR CLEANING FINE COAL

Kindig, J. K. and Charmbury, H. B. (Dept. Miner. Prep.), The Pa. State Univ., Spec. Res. Rept. to Pa. Coal Res. Bd., SR-30 (1962). 78 pp. A number of runs were made on the Cannon circular concentrator, a launder-type punched sluice device to clean fine coal. 662.6 P4

D62-10 FLOCCULATION AND THICKENING COAL-WASHERY REFUSE PULPS

Matheson, G. H. and Mackenzie, J. M. W., Coal Age 67 (12), 94-100 (1962). The theory of electrolyte and polymer flocculation is related to laboratory and plant results. A conclusion is that for maximum benefits from flocculant addition thickeners should be operated with a considerable volume of clear water to permit adequate dilution of the incoming feed and promote floc growth. Jour

D62-11 USING COAL REFUSE IN BUILDING MATERIALS

Myers, J. W., Pfeiffer, J. J., and Orning, A. A., Trans. AIME 223, 53-61 (1962). To process washery refuse for use as a building material aggregate, it was crushed and pelletized before being sintered in small pilot plant using a travelling grate. One product was evaluated commerically in building blocks. Aggregate was evaluated for staining, free organic matter, and size grading. Some fluxing lime was used to lower sintering temperature. Refuse materials vary considerably and processing may or may not give acceptable product. Jour

D62-12 RECOMMENDATIONS FOR THE CONSTRUCTION AND SECURING OF SLOPES (EXTRACTS)

Working Party 8a for "Stability of Slopes and Slips," of Subcommittee B of the German Association for Soil and Foundation Structures, Die Bautechnik 39 (12), 404/415 (1962). National Coal Board Translation A.2699/AGR. 2pp. In preparing the ground before building a waste disposal pile the water should be drained off and non-load-bearing ground should be removed unless it is possible to ensure a firm base in some other way. Methods of slope and soil stabilization are summarized. D234

D62-13 SIMULTANEOUS COAL GETTING AND STOWING

Colliery Eng. 39, 204-205 (1962). The operation at Monk Bretton Colliery near Barnsley is described. Coal is being mined on three shifts a day and refuse is being stowed simultaneously on two shifts. D212

D62-14 IMPROVING FINE-COAL FILTERING

Swan, J. D. (Consolidation Coal Co.), Coal Age 67 (11), 90-92 (1962). The results of a laboratory study to improve the handling characteristics of the cake from the vacuum filtration of coal fines are given. In a demonstration run, a combination of surfactant and flocculent changed the filter cake from being wet, rubbery and hard to handle to a cake that had less moisture and was brittle. Jour

1963

D63-1 BELT LOADER RECLAIMS CULM BANK

Coal Age 68 (10), 178 (1963). The article describes the machinery and method of operation used by the D. A. Kessler Construction Co. to move coal refuse. The material was processed by Wright Coal Co., Trevorton, Pa., to recover anthracite fines. Jour

D63-2 A GUIDE FOR SCREEN AND COVER PLANTING OF TREES ON ANTHRACITE MINE-SPOIL AREAS

Frank, R. M. (Northeastern Forest Expt. Sta.), U.S. Forest Serv. Res. Paper NE-22 (1963). 50 pp. The guide describes the maps prepared for major communities, counties, and the entire anthracite region, showing areas disturbed by surface mining, areas used for disposal of refuse from deep mining, and potential planting sites needed to screen these areas from view or to cover them. Planting stock requirements are also reviewed. R197

D63-3 HORIZONTAL FINE-COAL RECOVERY SCREENS HELP BOOST PROFITS

Coal Age 68 (6), 132 (1963). The use of horizontal vibrating screens for recovery of fine coal is described. Jour

D63-4 COMPARATIVE STUDY OF SOLID STOWING METHODS

Kis-Tamas, L., Colliery Guardian 207, 547-552, 586-590 (1963). In this entry in the Students' Prize Competition hydraulic and pneumatic stowing and the various system design characteristics are discussed. The use of reserve refuse from the surface in addition to current mining refuse and washery reject is also considered. A detailed plan is given for the extraction and stowing of two seams close to each other at the Ellistown North and Central Districts. D219

D63-5 COAL FLOTATION OF LOW-GRADE PENNSYLVANIA ANTHRACITE SILTS

Liu, H. S. and Sun, S. C. (Dept. Miner. Prep.), The Pa. State Univ., Spec. Res. Rept. to Pa. Coal Res. Bd., SR-39 (1963). 126 pp. A flotation method was developed to upgrade silts of 40 to 53 percent ash to clean coal of 14 to 16 percent ash and 80 to 85 percent combustible recovery. 662.6 P4

D63-6 LOW-PRESSURE PNEUMATIC STOWING

Morris, A. H. and Pentith, G. R. O., Steel & Coal 186, 171-186, 289-290 (1963). Low pressure stowing has a cost advantage over pneumatic stowing with medium or high pressure. The stowing installations and equipment at three collieries are described and information is given on costs and methods of operation. D216, D217

D63-7 BITUMINOUS COAL FINES: A LOW COST FILLER FOR RUBBER AND PLASTICS

Mueller, W., Palinchak, S., and Stickney, P. (Battelle Memorial Inst.), Rubber Age 93 (2), 255-264 (1963). The characteristics of low-volatile bituminous coal fines are tabulated. They are shown to result in materials with properties generally comparable to materials made with other fillers. D257

D63-8 A NEW CRUSHER-STOWER

Steel & Coal 186, 812-813 (1963). The Brieden crusher-stower and its operation are described. D218

D63-9 DETECTION OF UNDERGROUND BURNING COAL FIRES WITH INFRARED RECONNAISSANCE EQUIPMENT

Psolka, F., Short Circuit, HRB-Singer, Inc. 13 (10), 1-2 (1963). Aerial surveys were made over an anthracite refuse bank of the Glen Alden Co. using the infrared surveillance system which is a thermal sensing device that records variations in radiated energy caused by changes in surface temperatures. This method detects underground burning activity through measurements made on the surface which is warm, cold or hot depending on conditions and locations of the underground burning. Two flights were made at night on this project. 360. 63-2

D63-10 DETECTION OF UNDERGROUND BURNING COAL FIRES WITH INFRARED RECONNAISSANCE EQUIPMENT

Psolka, F. F., Frank, J. D., and Woodbridge, C. L., HRB-Singer, Inc., Rept. to Pa. Dept. Mines Miner. Ind., S-74 (1963). 13 pp.+ This detection method uses infrared technique to define status of burning coal refuse banks at Richmond Colliery and Hudson Coal Co. at Scranton, Pa. and Huber Colliery in Ashley-Sugar Notch near Wilkes-Barre. Large temperature variations can be detected on surface, areas can be defined and variations in temperature contours can be obtained. 360. 63-1

D63-11 WEMCO HMS AND FLOTATION AT N.C.B. BADDESLEY COLLIERY

WEMCO (Div. Arthur G. McKee & Co.) - On the Job, G6-SI 11 (undated). The operation of WEMCO machinery in recovering coal is described. D269

1964

D64-1 BREAKER REFUSE - A SCENIC BLIGHT OR AN ASSET

Bellano, W. (Glen Alden Coal Co.), Coal Mining Process. 1 (7), 23-25 (1964). The author points out that present methods of coal cleaning leave significantly less coal in the refuse than was the case with older less efficient methods. He discusses using currently produced refuse as land fill material. Chemical analysis, proximate analysis and size consist of typical refuse samples are given. 360. 64-2

D64-2 COAL SAVED, POLLUTION CONTROLLED BY GUYAN 1 FINE-COAL PLANT

Coal Age 69 (3), 87-88 (1964). This article describes the fine coal processing plant of Guyan No. 1 mine of Island Creek Coal Co., Amherstdale, W. Va. Detailed flow sheet is included showing how water and air pollution are eliminated. Operation is meeting state requirements. Jour

D64-3 LOW-COST REFUSE DISPOSAL

Dress, L., Coal Mining Process. 1 (1), 31, 46 (1964). The coal waste slurry pipeline system of Truax-Traer Coal Co. preparation plant in DuQuoin, Ill. handles all refuse from coal washing, ash from the heat dryer and heating boiler, dust and spillage from floors, and effluent from centrifugal dryers. Disposal is into refuse ponds where solids settle out and water is decanted to an adjacent pond. Pumps and piping are described and operating data and cost are listed. D282

D64-4 RECLAIMING FINE COAL FROM SETTLING PONDS

Ferney, F. X. (Bird Machine Co.), Mining Congr. J. 50 (4), 48-50 (1964). The method, equipment, and costs of fine coal recovery from a slurry pond at the Banning Mine of Republic Steel Corp. are discussed. D254

D64-5 CHARACTERISTICS OF REFUSE BANK MATERIALS WHICH CONTROL BURNING AND POTENTIAL USE

Lovell, H. L., Mitchell, D. R., Kindig, J. K., and Peters, J. W., AIME Ann. Meet., New York, 1964. Preprint No. 64F54. 22 pp. The Penn State studies on coal refuse reviewed in this paper are characterization of refuse, combustion behavior of raw refuse and beneficiation and utilization of refuse. 360. 64-1

D64-6 AN INVESTIGATION OF THE CYCLONE FOR FINE COAL CLEANING

Munn, K. J. and Lovell, H. L. (Dept. Miner. Prep.), The Pa. State Univ., Spec. Res. Rept. to Pa. Coal Res. Bd., SR-45 (1964). 104 pp. With a three inch cyclone using only water medium to clean fine coal, ash was reduced from 26 to 14 percent with a 45 percent yield. Sulfur could not be reduced in one cyclone. Different apex orifices were used to determine maximum

D64-6 (continued)

performance. It appears the cyclone will be most effective in a multi-stage process which will probably include other operations such as sieve bend and flotation. 662.6 P4

D64-7 PRODUCTION OF LIGHTWEIGHT AGGREGATE FROM WASHERY REFUSE

Myers, J. W., Pfeiffer, J. J., and Orning, A. A., U.S. Bur. Mines, RI 6449 (1964). 19 pp. Work done on two refuse materials to prepare lightweight aggregate is described. The products made in a pilot sintering plant met ASTM specifications. Apparatus and test procedures used are also described and test data are tabulated. BurM

D64-8 NEW SUBSIDENCE-CONTROL PROJECT IN PENNSYLVANIA ANTHRACITE REGION APPROVED BY INTERIOR DEPARTMENT

U.S. Bur. Mines, News Release, Sept. 7, 1964. Under Public Law 87-818, a portion of the abandoned Buttonwood-Nottingham mine complex will be filled to control subsidence in Plymouth Borough, Pa. Coal breaker refuse will be introduced into the mine by blind-flushing. An example of subsidence in the borough is given. 302. 64-1

D64-9 PROPERTIES OF HYDRAULIC BACKFILLS AND PRELIMINARY VIBRATORY COMPACTION TESTS

Nicholson, D. E. and Wayment, W. R., U.S. Bur. Mines, RI 6477 (1964). 31 pp. Field sampling of in-place densities of fills presently used in four different mines, and laboratory and underground compaction tests using a standard concrete vibrator show that the initial in-place density of the cohesionless fill material tested can be significantly increased by vibratory compaction. BurM

D64-10 PIT-HEAP PLANTS WIN COAL FROM WASTE

Colliery Guardian 208, 444 (1964). This news item describes a process developed in Hungary and used also in Poland. Material for road-building and for cement factories and brick works is produced as well as fine coal for industrial boilers. D221

D64-11 RECLAMATION OF COAL FROM PIT DIRT: A PROFITABLE METHOD OF MAKING UP COLLIERY OUTPUT

Colliery Eng. 41, 4-10 (1964). The coal recovery plant at the Baddesley Colliery, Great Britain is described. Representative washability data are tabulated and the economics of the process are summarized. D220

D64-12 SCRANTON, PENNSYLVANIA MINE-FILLING PROJECT APPROVED

U.S. Bur. Mines, News Release, April 9, 1964. A $1-1/4 million Federal-State project to fill mined-out areas under heavily built-up sections of

D64-12 (continued)

Scranton is described. Some 660,000 cubic yards of crushed mine refuse will be flushed into the voids. 302. 64-1

D64-13 SURVEY OF BURNING COAL-MINE REFUSE BANKS

Stahl, R. W., U.S. Bur. Mines, IC 8209 (1964). 39 pp. This survey includes details of 495 refuse banks in 15 states. The location, name, size, status of bank, stage of fire are included. Controlling methods are reviewed plus compacting and sealing. There are many tables, diagrams and maps. BurM

D64-14 SUCCESSFUL DEBUT OF BEIEN BREAKER STOWER

Colliery Eng. 41, 312-314 (1964). The rail-mounted machine crushes and stows debris without interfering with work at the coal face. There are water sprays for dust suppression. Where height is a problem, the breaker and stower can be separated. Experience with the machine in the NCB East Midlands District is described. D222

D64-15 PENNSYLVANIA'S REGULATION 1: A BLOW TO AIR POLLUTION

Sussman, V. H., Coal Mining Process. 1 (5), 32-33 (1964). Under passage of the new Regulation 1, the Air Pollution Commission is given authority to act in the cases of burning refuse piles and to require permits for operation of a disposal area. The Department of Health is to investigate each burning pile and following its report the Commission will issue orders for prompt elimination of the condition. The Regulation provides standard procedures for construction of refuse piles and these are used as a basis for issuing permits. 712.122 64-2

D64-16 UTILIZATION OF COAL REFUSE FOR THE MANUFACTURE OF LIGHTWEIGHT AGGREGATE

Utley, R. W., Lovell, H. L., and Spicer, T. S., Pa. State Univ., Spec. Res. Rept. to Pa. Coal Res. Bd., SR-46 (1964). 98 pp.+ The purpose of this investigation was to study the relationship between the washability fractions of coal refuse and the quality of lightweight aggregate products prepared from such refuse. Work was carried out on three samples of current refuse, each weighing three thousand pounds, and collected in such a manner that they were representative of the material actually being discarded. The 1/4 inch by 8 mesh fraction of screened material was subjected to extensive washability studies. Ten sink float separation products were subject to spectrochemical analysis for the major constituents. Ten similar sink fractions and a composite sample were fired both as a pellet and as a powder and the resulting products tested for specific gravity percent expansion and compressive strength. The characteristics of coal refuse that contribute to making a good lightweight aggregate are identified. (From authors' summary) D14

1965

D65-1 COAL-ASSOCIATED MINERALS OF THE UNITED STATES. PART 1. PENNSYLVANIA AND MARYLAND COAL-ASSOCIATED MINERAL OCCURRENCES AND MARKETS

Bucklen, O. B., et al., W. Va. Univ., Coal Res. Bur., R&D Rept. No. 8 to U.S. Office Coal Res. (1965). (89 pp.) NTIS, PB-168 110. In the separate section for each state the information is arranged according to coal seams and includes mineral composition of the strata relating to each particular seam. Each section has a bibliography and maps showing the location of coal seams, industries, power plants, and transportation facilities. OCR W5 8

D65-2 COAL-ASSOCIATED MINERALS OF THE UNITED STATES. PART 2. OHIO COAL-ASSOCIATED MINERAL OCCURRENCES AND MARKETS

Bucklen, O. B., et al., W. Va. Univ., Coal Res. Bur., R&D Rept. No. 8 to U.S. Office Coal Res. (1965). (91 pp.) NTIS, PB-168 111. This report contains information on 20 coal seams. Limestone is the predominant material, together with some clay and a small amount of ore. Detailed descriptions of each seam are included and the analysis of the associated mineral is given. Market outlet information includes the transport distance and the number of industries in the counties in which the seams are mined which could use the minerals. Maps show location of the coal seams. OCR W5 8

D65-3 COAL-ASSOCIATED MINERALS OF THE UNITED STATES. PART 3. WEST VIRGINIA COAL-ASSOCIATED MINERAL OCCURRENCES AND MARKETS

Bucklen, O. B., et al., W. Va. Univ., Coal Res. Bur., R&D Rept. No. 8 to U.S. Office Coal Res. (1965). (82 pp.) NTIS, PB-168 112. In this report, 21 coal seams are described. Each listing includes analyses of the associated clay, shale, sandstone, and/or limestone. A series of maps shows the probable extent of minable reserves in each area. Other information presented is the market potential for each mineral and proximate analyses of the coals included in this part of the study. OCR W5 8

D65-4 COAL-ASSOCIATED MINERALS OF THE UNITED STATES. PART 4. SOUTHERN APPALACHIA COAL-ASSOCIATED MINERAL OCCURRENCES AND MARKETS (VIRGINIA, EASTERN KENTUCKY, TENNESSEE, ALABAMA)

Bucklen, O. B., et al., W. Va. Univ., Coal Res. Bur., R&D Rept. No. 8 to U.S. Office Coal Res. (1965). (55 pp.) NTIS, PB-168 113. This report shows that Virginia has a large coal-associated sandstone reserve, Tennessee has almost no limestone and little clay and shale, and eastern Kentucky and Alabama have both clay and shale. Stratigraphic charts show the various coal seams and associated minerals in each state and proximate analyses for the respective coal seams. Each state section has a bibliography and also maps showing locations of all seams. OCR W5 8

D65-5 COAL-ASSOCIATED MINERALS OF THE UNITED STATES. PART 5. MID-WESTERN COAL-ASSOCIATED MINERAL OCCURRENCES AND MARKETS (ILLINOIS, WESTERN KENTUCKY, INDIANA, MISSOURI, KANSAS, IOWA AND TEXAS)

Bucklen, O. B., et al., W. Va. Univ., Coal Res. Bur., R&D Rept. No. 8 to U.S. Office Coal Res. (1965). (145 pp.) NTIS, PB-168 114. Information for each state is considered in a separate section with its own bibliography and other selected references. Coal occurrence is shown on maps and market potential of various minerals is tabulated. For Illinois, Kentucky, Indiana, and Kansas, coal seams and related strata are described and proximate analyses of the coals of the various seams and amounts of minerals in the various strata are given. Coals of Missouri, Iowa, and Texas are discussed generally because there is a lack of coal seam correlation. Physical properties of Iowa clays are tabulated, as is the germanium content of a number of Kansas coals. OCR W5 8

D65-6 COAL-ASSOCIATED MINERALS OF THE UNITED STATES. PART 6. WESTERN COAL-ASSOCIATED MINERAL OCCURRENCES AND MARKETS (COLORADO, MONTANA, NEW MEXICO, NORTH DAKOTA, UTAH, SOUTH DAKOTA, WASHINGTON AND WYOMING)

Bucklen, O. B., et al., W. Va. Univ., Coal Res. Bur., R&D Rept. No. 8 to U.S. Office Coal Res. (1965). 69 pp. NTIS, PB-168 115. Information for each state shows extent of coal occurrence and related strata, mineral analyses of strata, possible commercial potential, and a list of references. The uranium content of lignites and coals is shown. OCR W5 8

D65-7 COAL-ASSOCIATED MINERALS OF THE UNITED STATES. PART 7. USES, SPECIFICATIONS AND PROCESSES RELATED TO COAL-ASSOCIATED MINERALS

Bucklen, O. B., et al., W. Va. Univ., Coal Res. Bur., R&D Rept. No. 8 to U.S. Office Coal Res. (1965). 131 pp. NTIS, PB-168 116. This extensive review consists of the following detailed sections: A. Coal-associated clays and shales; B. Coal-associated limestone; C. Coal-associated sandstone; D. Coal-associated fly ash; E. Minor coal-associated minerals; F. Miscellaneous coal-associated elements affecting coal utilization; and G. Multi-product mining and preparation with conventional methods. Each section identifies the extent, quality, and probable uses of potentially valuable minerals located above, in, and below significant coal seams of the United States. 44 References. OCR W5 8

D65-8 DENSE MEDIA PLANT PROCESSES CULM BANK MATERIAL

Hewes, R. B., Coal Mining Process. 2 (5), 34-39 (1965). This article describes a project to recover coal from anthracite refuse by State Coal Co., Shamokin, Pa. Coal recovered averages 18-20 percent of the feed. Rejects are used as fill material for old strip pits. Pictures and detailed diagrams of the process are included. 360. 65-5

D65-9 MINUS 48 MESH REFUSE DISPOSAL AT U.S. STEEL'S GARY CENTRAL COAL PREPARATION PLANT

Hummer, E. D., Mining Eng. 17 (3), 63-66 (1965). The refuse pumping system, dam design, and impoundment practice used by United States Steel Corp.'s Gary, West Virginia preparation plant for disposal of minus 48 refuse are discussed. D274

D65-10 REPROCESSING BITUMINOUS COAL REFUSE

Kindig, J. K. and Irons, D. S., Mining Congr. J. 51 (7), 36-39 (1965). A 50 tph refuse processing plant was built and operated on Barnes and Tucker property by Pennsylvania State University. A heavy media system was part of the process which is shown in a detailed flow sheet. The object of the program was to remove a low grade coal product from refuse thereby eliminating burning piles. D76

D65-11 USEABLE FUEL RECOVERED FROM COLLIERY WASTE

Nash, W. L. G., Coal Mining Process. 2 (5), 40-41 (1965). The SIMDEX process, developed and used in Hungary and Poland as the Haldex process, is described. It is a hydrocyclone washery which uses the fines present in the crushed feed to form the separating medium. D306

D65-12 NEW RECLAIM-TYPE PLANT PRODUCES QUALITY COAL, PROVIDES BACK-FILLING

Coal Age 70 (4), 118-122 (1965). Usable coal from old anthracite tailings (culm) banks is recovered in centrifugal and bath-type heavy media units. The reject from the process is used in filling abandoned strip-mine pits. Jour

D65-13 PENN STATE STARTS PLANT TO TEST BANK PROCESSING

Coal Age 70 (3), 29 (1965). This is a short article describing the 50 tph heavy-medium refuse processing plant built by Heyl and Patterson near Barnesboro. The project was initiated by H. Beecher Charmbury then Secretary of Mines in 1962. Jour

D65-14 PROCESS MAY REDUCE POLLUTION FROM BURNING COAL REFUSE PILES

Chem. Eng. News 43 (4), 49-50 (Jan. 25, 1965). This short article describes pilot plant using heavy media to separate high-ash coal from nonburnable waste rock. Plant was built at Barnesboro, Pa. The process was originated by H. B. Charmbury of Pennsylvania State University. Coal is crushed to less than 1 inch. 360. 65-1

D65-15 FINE COAL RECOVERY AND MINE BACKFILL PREPARATION AT KAISER STEEL CORPORATION, SUNNYSIDE, UTAH

Shoemaker, J., Denver Equipment Company, Bull. No. M4-B114 (undated). 8 pp. Flow sheets are shown for both the coal recovery and mine backfill

D65-15 (continued)

preparation plants and the systems are described. Backfill is pumped into obsolete entries and worked-out areas. Water drains through burlap covering timber dams and is returned to the main sumps for reuse. D235

D65-16 THE SIMDEX WASHING PROCESS

Colliery Eng. 45, 480-482 (1965). The patented process, developed in Hungary, used fines present in the feed to form the separating medium. A flow sheet shows the entire coal recovery process. D223

D65-17 THE PREPARATION OF COAL REFUSE FOR THE MANUFACTURE OF LIGHT-WEIGHT AGGREGATE

Utley, R. W., Lovell, H. L., and Spicer, T. S. (Pa. State Univ., College Miner. Ind.), Trans. AIME 232, 346-352 (1965). This article describes a study made using bituminous and anthracite refuse samples, separated at gravities 1.4 to 2.96. Chemical compositions were determined and aggregates were prepared in the laboratory at temperatures of 1250 to 1350 C. The fraction sinking at 2.60 gave aggregate with lowest gravity, greatest expansion and greatest compressive strength. D35

D65-18 A PILOT PLANT FOR TREATMENT OF CULM BANK MATERIAL

Walker, J. L., Jr., Heyl & Patterson, Inc., Rept. to Pa. Dept. Mines Miner. Ind., 1965. 24 pp. This report outlines the preliminary progress made on the project to recover coal. The processing pilot plant was built on old property of Dickson Coal Co., Scranton, Pennsylvania. The report includes investigation and exploration, process design and engineering, procurement and fabrication of materials, erection and installation.
360. 65-4

D65-19 ANTHRACITE REFUSE DISPOSAL

Williams, I. L. and Stortz, A. F., Mining Congr. J. 51 (8), 33-35 (1965). In this account of Glen Alden Coal Company's disposal program, pictures show how refuse is handled and stock-piled. A list of guide lines for proper disposal is included. 360. 65-3

1966

D66-1 ABERFAN INQUIRY

"Aberfan inquiry: first week," Engineering 202, 1004-1005 (Dec. 9, 1966). "Sixth week of Aberfan inquiry," Engineering 203, 161 (Feb. 3, 1967). "Aberfan: area engineer's evidence," Engineering 203, 247 (Feb. 17, 1967). "Aberfan: new instructions on responsibilities," Engineering 203, 374-375 (Mar. 10, 1967). "Aberfan inquiry: expert evidence," Engineering 203, 667 (Apr. 28, 1967). "Aberfan: the technical report," Engineering 204, 208-209

D66-1 (continued)

(Aug. 11, 1967). These news items report the information brought out at the hearings on the disastrous coal refuse pile slide which killed 144 persons in Wales. D252

D66-2 COAL PREPARATION -- MEETING THE CHALLENGES

Coal Age 71 (9), 99-114 (1966). Discussion of inplant processes includes plant design, contributions of cyclone technology, improving coal classification, flotation, filtration, thermal and mechanical dewatering, and handling plant water. In the section on refuse handling and storage both underground and surface storage are considered. Jour

D66-3 STUDY OF SOME FACTORS IN THE FLOCCULATION OF COAL WASHERY TAILINGS

Dru, G. (Centre d'Etudes et Recherches des Charbonnages de France), Fifth Int. Coal Prep. Congr., Pittsburgh, Pa., by U.S. Bur. Mines and Amer. Mining Congr., 1966. Paper D6. pp 267-279. This paper on the removal of suspended solids from coal washery water covers various flocculants available, the operating method, and factors affecting flocculation including changes in the shale, the water and the flocculant as a function of the time, and the influence of pH and temperature. Both laboratory studies and commercial-scale use tests are reported. (Adapted from Introduction) 662.6 I927

D66-4 AN INVESTIGATION OF THE CLEANING OF BITUMINOUS COAL REFUSE FINES BY AN EXPERIMENTAL HYDROCYCLONE

Falconer, R. A. and Lovell, H. L. (Dept. Miner. Prep.), The Pa. State Univ., Spec. Res. Rept. to Pa. Coal Res. Bd., SR-58 (1966). 121 pp. The objectives of the investigation were (1) to determine by statistical methods the combination of hydrocyclone dimensional parameters that yield the optimum rejection of ash and sulfur constituents to the underflow product and (2) to analyze the relative contributions made by three different cone angles to the rejection of ash and sulfur constituents to the underflow product. (From Summation of Results) 662.6 P4

D66-5 MINE BACKFILLING WITH PNEUMATIC STOWING. PART I. PNEUMATIC CONVEYING OF STOWING MATERIAL; PART II. APPLICATIONS OF STOWING

Jerabek, F. H. and Hartman, H. L., Mining Congr. J. 52 (5), 51-56, 58-60, and (6), 69-71, 76-79 (1966). Current state-of-the-art in pneumatic stowing is reviewed in Part I. Particularly emphasized are design considerations and determination of system parameters. Part II deals with preparing the material, costs, the disadvantage of dust formation, and maintenance of equipment. The material handling system is critical to successful pneumatic stowing. Good performance is obtained using suitable equipment and efficient scheduling of underground operations. 302. 66-6

D66-6 PUMPING: A GOOD WAY TO DISPOSE OF COAL PLANT REFUSE

Levin, P., Coal Mining Process. 3 (7), 30-33 (1966). This article points out the merits of pumping refuse, including low operating costs, minimum capital investment, flexibility in pumping and disposal and elimination of dewatering units. Several plant examples and costs are given. 445.1 66-1

D66-7 THE EVALUATION OF ANTHRACITE REFUSE AS A HIGHWAY CONSTRUCTION MATERIAL

Luckie, P. T., Peters, J. W., and Spicer, T. S. (Dept. Miner. Prep.), The Pa. State Univ., Spec. Res. Rept. to Pa. Coal Res. Bd., SR-57 (1966). 66 pp. Indications are that raw refuse could not be used in highways, and beneficiated refuse could only be used as embankment fill. 662.6 P4

D66-8 METHODS EMPLOYED FOR UNDERGROUND STOWING (A RESUME OF A LITERATURE SURVEY)

Luckie, P. T. and Spicer, T. S. (Dept. Miner. Prep.), The Pa. State Univ., Spec. Res. Rept. to Pa. Coal Res. Bd., SR-55 (1966). 55 pp. There are 120 references in this review and discussion of the literature. 662.6 P4

D66-9 UNDERGROUND STOWING OF ANTHRACITE REFUSE FOR SURFACE SUPPORT

Maneval, D. R., Charmbury, H. B., and Lambert, R. A. (Pa. Dept. Mines Miner. Ind.), Ann. Meet. AIME, New York, N.Y., 1966. Preprint No. 66F61. 9 pp. A revision of the paper published as "Pennsylvania stows refuse to bolster abandoned coal mines," Mining Eng. 19 (4), 82-84 (1967). The case history of the project to backfill a mine of the Diamond Colliery in Scranton, Pa. is related as an example of the technique of pneumatic stowing or flushing refuse into mine voids to control surface subsidence. 302. 66-1, 67-1

D66-10 IGNITION AND CONTROL OF BURNING OF COAL MINE REFUSE

Myers, J. W., Pfeiffer, J. J., Murphy, E. M., and Griffith, F. E., U.S. Bur. Mines, RI 6758 (1966). 24 pp. Laboratory experiments showed minus 3-1/2 inch refuse ignites spontaneously more readily than minus 1/4 inch refuse. Burning of 1,000 pound conical coal pile was controlled by capping with an 18 inch thick layer of minus 1/4 inch refuse containing 37 percent combustible material. BurM

D66-11 A PILOT PLANT FOR TREATMENT OF CULM BANK MATERIAL

Heyl & Patterson, Inc., Final Rept. to Pa. Dept. Mines Miner. Ind., 1966. 26 pp.+ Work done to separate coal from refuse material in the anthracite region leads to the conclusion that coal can be reclaimed from many culm banks and that the secondary refuse is practically non-combustible material which can be used for fill. Pictures of the pilot plant together with process diagrams show the method used. Tabulated data are given for a number of culm materials. Each source is an individual case and must be evaluated to find out actual costs. D142

D66-12 PIT WASTE INTO LIGHTER CONCRETE

New Scientist 29 (477), 20 (1966). This Polish process uses carbonaceous shale from refuse heaps. The material is self-burning after it is ignited. The low density, high compressive strength product has good noise and heat insulation properties. D276

D66-13 PLANT COLONIZATION STUDIES ON BLACK WASTES FROM ANTHRACITE MINING IN PENNSYLVANIA

Schramm, J. R. (Indiana Univ.), Trans. Am. Philosophical Soc. 56, Pt. 1 (1966). 194 pp. This report covers plant growth and maintenance on anthracite waste piles. It is highly descriptive and contains many pictures of various plants and root systems. 631 S377, 66-168

D66-14 SOIL EROSION OF THE SLOPES OF WASTE DUMPS BY WATER

Smolik, D. (Land Reclam. Res. Sta., Ostrava), Uhli No. 12, 452-453 (1966). NCB Trans. A. 2615. One method of preventing self-ignition of coal waste dumps is to spread a thick cover of soil over them. However, the erosion of the soil must be prevented. The amount of erosion on a covered refuse dump was measured by catching the washed-off soil and drying and weighing it. The tabulated data indicate the need for anti-erosion measures, such as proper grading and revegetation, as soon as possible. D124

D66-15 THIRD ANTI-SUBSIDENCE PROJECT APPROVED BY INTERIOR DEPARTMENT FOR PENNSYLVANIA ANTHRACITE REGION

U.S. Bur. Mines, News Release, May 27, 1966. The project for controlling subsidence in Coaldale, Pa. is announced. Blind-flushing and land-fill with coal refuse is planned. Subsidence in the area is described. 302. 66-2

D66-16 INVESTIGATIONS OF THE CYCLONE WASHING OF FINE COAL IN WATER

Weyner, L. H. E. and Lovell, H. L. (Dept. Miner. Prep.), The Pa. State Univ., Spec. Res. Rept. to Pa. Coal Res. Bd., SR-61 (1966). 271 pp. Three major aims of the work were: 1. the analysis of the pressure requirements of a wide angle cyclone with relatively high solid-to-pulp ratios of the feed; 2. the analysis of the flow ratio of such cyclone; 3. an investigation of the separation of a typical fine coal according to the recovery of solids in the apex product, the rejection of ash and sulfur, and the response from particle density. (From Summary) 662.6 P4

1967

D67-1 THE ABERFAN REPORT

The Engineer 224, 179-181 (Aug. 11, 1967). This is an abstract of part V of the report which discusses the causes of the disastrous flow-slide of the refuse; and a reprint of the findings and summary of the report. D252a

D67-2 EASTERN COAL PELLETIZES TO RECOVER FINES, STEM POLLUTION

Mining Eng. 19, 24 (Sept. 1967). Fine coal is recovered by froth flotation from the cleaning plant effluent at the Stone, Ky. plant of Eastern Coal Corp. The coal filter cake is blended with a binder and then pelletized. D270

D67-3 PELLETIZING FINE COAL RECOVERED FROM PUMPED REFUSE

Egan, H. N., AIME Fall Meet., Rocky Mountain Minerals Conf., Las Vegas, Nev., Sept. 6-8, 1967. Preprint No. 67F307. 8 pp. Also published in Mining Eng. 19 (11), 73-75 (1967). Eastern Coal Corp., Stone, Ky. found that 80 percent of their fine coal refuse could be recovered at an acceptable ash content. Since the fine coal had completely different characteristics from the cleaned coal product it required separate handling. The pelletizing plant that prepares a product suitable for shipping is described. The problems encountered in the shake down period of operation are discussed. D225 440.6 67-1

D67-4 GUIDELINES FOR THE APPROVAL OF TIP-HEAPS SET UP WITHIN THE AREA ADMINISTERED BY THE MINE (EXTRACTS)

Ministerialblatt für das Land Nordrhein Westfalen, 1967. pp 168-192. National Coal Board Translation A.2697/AGR. Criteria for refuse pile construction are summarized. D233

D67-5 RECOVERY OF PYRITES FROM COAL REFUSE--A PILOT PLANT STUDY

Lovell, H. L. (Pa. State Univ., Dept. Miner. Prep.), AIME Fall Meet., Rocky Mountain Minerals Conf., Las Vegas, Nev., Sept. 6-8, 1967. Preprint No. 67F351. 12 pp. Lower Kittanning seam refuse was processed in a heavy media cyclone plant constructed at Barnes and Tucker Coal Co. to investigate the possibility of pyrite recovery as a source of sulfur. Washability and sulfur recovery data are tabulated and show the difficulty of achieving adequate separation of pyrite. 440. 67-5

67-6 PELLETIZING MAKES WASTE PAY OFF

The Iron Age 199, 82 (June 15, 1967). The plant built by Eastern Coal Corp. to recover and pelletize fine coal is described. D238

D67-7 THE EFFECT OF SELECTED CALCINING TEMPERATURES ON ALUMINA EXTRACTION FROM COAL ASSOCIATED DRAW-SLATE

Shafer, H. E., Jr. and Solomon, J. A. (W. Va. Univ., Coal Res. Bur.), Trans. AIME 238, 101-103 (1967). Also published as W. Va. Univ., Coal Res. Bur., Tech. Rept. No. 23 (Undated). 9 pp. Work has been done on coal related material to find the optimum temperature for calcination which would give maximum extraction of alumina by sulfuric acid. The material was pulverized, calcined, leached with acid, and the product precipitated as aluminum sulfate. Pulverizing was to minus 30 mesh and calcining temperatures ran from 100 to 700 C. Details of results

D67-7 (Continued)

are discussed. Calcining at about 500 C seems most favorable for alumina extraction. Jour and 662.6 W521

D67-8 THAT REFUSE PILE MAY BE A TREASURE TROVE

Coal Mining Process. 4 (8), 59-60, 62 (1967). Amigo Smokeless Coal Co. has added a preparation plant to its Wyco, W. Va. facility. Plant operation includes processing refuse and middlings from fine coal air tables. The coal produced by heavy media separation and froth flotation is a high grade metallurgical product with less than five percent ash and less than one percent sulfur. The process units and equipment are described. The thickener underflow is sent into old mine workings. 440.3 67-4

D67-9 POLLUTION CONTROL IN MINING AND PROCESSING OF INDIANA COAL

Woodley, R. A. and Moore, S. L., J. Water Pollut. Contr. Fed. 39, 41-49 (1967). Graphs show coal production, number of active mines and annual acreage disrupted and reclaimed. A map gives the stream miles affected by mine drainage. Quality of drainage from a coal refuse site is tabulated. Jour

D67-10 RECOVERING SULFUR AND IRON FROM COAL PYRITES

Zimmerman, R. E. and Roman, G. H., Coal Age 72 (4), 60-71 (1967). This very comprehensive article gives refuse analyses, pyrite products and recovery history, and describes pyrite roasting methods and gives acid manufacturing process diagrams. Data also include theoretical pyrite yields from plant refuse and recovery from high sulfur coals. A detailed pyrite processing diagram is included. Jour

1968

D68-1 MAINTENANCE OF REFUSE DISPOSAL AREAS

Beerbower, R. C., Jr., Coal Age 73 (2), 102-106 (1968). Article describes work done by U.S. Steel at the Maple Creek Mine, New Eagle, Pa. Area was cleared and refuse was spread on in layers using a slope of 1:1 or 1:2 depending on terrain. The slopes are covered with about 10 inches of clay before planting. White, Austrian and red pine seedlings were planted on slopes and face of slurry pond dam. Jour

D68-2 AVOIDING POLLUTION FROM REFUSE DISPOSAL

Calhoun, F. P. (Rochester & Pittsburgh Coal Co.), Mining Congr. J. 54 (6), 78-80 (1968). Following a few fundamental rules in building the refuse pile can keep the pile from causing a pollution problem as well as from becoming an eyesore after it is abandoned. This is the account of the Rochester & Pittsburgh Coal Co. disposal program. Pictures give before and after appearances. Jour

D68-3 CONTROL OF REFUSE DISPOSAL POLLUTION

Calhoun, F. P. (Rochester & Pittsburgh Coal Co.), Am. Mining Congr. Coal Convention, Pittsburgh, Pa., 1968. 4 pp. The paper describes a method of building a new refuse pile so that it will not cause pollution. 68-74

D68-4 EXTINGUISHMENT OF MINE WASTE FIRE AT ISELIN, PENNSYLVANIA

Carr, B. B., Callery Chemical Company Monthly Rept. No. 1 to Pa. Dept. Mines Miner. Ind., Feb. 1968. 13 pp. Work planned by the company in extinguishing a burning mine dump on the property of Rochester and Pittsburgh Coal Co. is described. Grading and temperature surveys are planned first followed by sealing techniques such as by polyurethane foam or soil solidification. 310.3 68-2

D68-5 SUBSIDENCE CONTROL IN THE ANTHRACITE FIELDS OF PENNSYLVANIA

Charmbury, H. B., Smith, G. E., and Maneval, D. R., ASCE Ann. Meet. and Natl. Meet. on Structural Eng., Pittsburgh, Pa., Sept. 30-Oct. 4, 1968. Preprint 721. 22 pp. Work has been done on three projects in the Scranton and Pittston, Pa., areas to stabilize abandoned and worked-out mines. Methods of hydraulic stowing either as "blind flushing" or as "controlled flushing" are described. D236

D68-6 FIRE EXTINGUISHING AGENT

Cooper, W. J. and Kyilonen, D. M. (to Callery Chemical Co., Pittsburgh, Pa.), U.S. Pat. 3,367,863 (Feb. 6, 1968). 2 pp. A slurry of very fine solids, made by heating together aluminum acid phosphate and a source of boron oxide, is sprayed on burning refuse piles. The water evaporates on contact with the hot surface and leaves a foamed continuous hard coating that fills cracks and deep crevices and thus prevents the pile from reigniting. US Pat

D68-7 WASTE TIP STABILIZATION IN THE RUHR

Corner, J. T. (Dollery and Palmer, Ltd.), Colliery Guardian 216, 250-253 (1968). This article describes in detail the methods used in the Ruhr for constructing and landscaping coal mine refuse piles. 68-189

D68-8 RESPONSE OF CROWNVETCH PLANTED ON ANTHRACITE BREAKER REFUSE

Czapowskyj, M. M., Mikulecky, J. P., and Sowa, E. A. (Northeastern Forest Expt. Sta., Upper Darby, Pa.), U.S. Forest Service, Research Note NE-78, 1968. 7 pp. The study object was to see if crownvetch could be established on coal-breaker-refuse by seeding or planting crowns and using several lime, fertilizer and mulch treatments. Details of the seeding and planting procedures are outlined and measurements made at end of each growing season. Results are tabulated. Refuse material had pH values ranging from 2.7 to 4.0 extremely low in fertility with negligible amounts of organic matter. Study showed that lime is essential in order for crownvetch to grow.

D68-8 (continued)

Fertilizer had little effect. Lime effects reported here were short-term effects. Since pyrite content of the refuse was high it was felt that lime effects might disappear when the pH reverts to its former level. D45

D68-9 COAL WASTE BANK STABILITY

Davies, W. E., Mining Congr. J. 54 (7), 19-24 (1968). This article describes in detail the physical characteristics of coal waste piles, their composition and reasons for stability. Considerable detail is included on locations of waste banks, particularly concerning causes of avalanches. Most of the information pertains to the conditions in the Appalachian area where many hillside dumps are located on very weak foundations. D69

D68-10 FIRE FIGHTING CONTRACTORS LEVEL MOUNTAINS OF BURNING COAL WASTE

Construction Methods 50, 64-67 (Mar. 1968). Two contractors used different methods, described in detail, to extinguish refuse bank fires in the anthracite region of Pennsylvania. In one case the contractor cut down the bank with draglines, scrapers, and dozers, using jet streams of water to extinguish the fire. In the other case, the contractor bored horizontal holes into the bank, shot it, soaked it with water, and then dozed it away. D226

D68-11 ECONOMIC IMPACT OF AIR AND WATER POLLUTION CONTROL ON COAL PREPARATION

Frankel, R. J. (Resources for the Future, Inc.), Mining Congr. J. 54 (10), 56-63 (1968). This article emphasizes closed water circuits in coal preparation also refers to dry cyclone for dust control. Discussion on cost estimates indicate difficulty in obtaining realistic figures. Washability data are included for many coals. Quality standards will affect competition. Jour

D68-12 TECHNOLOGIC AND ECONOMIC INTERRELATIONSHIPS AMONG GASEOUS, LIQUID, AND SOLID WASTES IN THE COAL-ENERGY INDUSTRY

Frankel, R. J. (Resources for the Future, Inc.), J. Water Pollut. Contr. Fed. 40, 779-788 (1968). Two examples are given to show that waste production and waste handling alternatives must be considered in an economic analysis of overall production costs. Jour

D68-13 DEWATERING COAL FLOTATION TAILING BY THE ADMIXTURE OF CRUSHED WASHERY REFUSE

Geer, M. R., Jacobsen, P. S., and Sokaski, M., U.S. Bur. Mines, RI 7110 (1968). 15 pp. The mineralogical composition of different refuse materials determines their ability to retain water. Particle size influences water holding capacity of refuse in which kaolinite and silica predominate. BurM

D68-14 GUIDES FOR OPERATING COAL REFUSE DISPOSAL AREAS UNDER AIR POLLUTION COMMISSION REGULATION I

Pa. Dept. Health, Air Pollution Comm. (undated. Obtained 5/24/68). 4 pp. The refuse disposal procedures cover site selection and preparation, pile construction, trouble-shooting, and silt ponds and banks. 717.338 68-1

D68-15 REFUSE MULCH BOOSTS TOMATO YIELD

Hawk, C. O., Friedman, S., McCullough, E. B., and Hiteshue, R. W., Coal Age 73 (6), 90-94 (1968). This article describes use of coal washery refuse as mulch to treat 100 tomato plants. One to two inches in 3 ft diameter around each plant increased output up to 30 percent in peak of season. Soil preparation, planting and cultivating details are given. Jour

D68-16 REFUSE REMOVAL AND DISPOSAL

Hummer, E. D. and Vogel, L. J., in "Coal Preparation," J. W. Leonard and D. R. Mitchell, Eds., New York: AIME, Seeley W. Mudd Series, 1968. pp 16-1 - 16-37. This thorough discussion covers refuse storage, belt conveyers, aerial tramways, and truck disposal, and hydraulic handling and disposal of fine refuse. 662.6 M681 1968

D68-17 A SURVEY OF THE LOCATION, MAGNITUDE, CHARACTERISTICS AND POTENTIAL USES OF PENNSYLVANIA REFUSE

Peters, J. W., Spicer, T. S., and Lovell, H. L., Pa. State Univ., Spec. Res. Rept. to Pa. Coal Res. Bd., SR-67 (1968). 180 pp. This study reviews the origin of the refuse banks. It presents data showing their location and estimated quantities. Included are 157 culm banks containing more than 451 million tons of refuse with an estimated content of 113 million tons of recoverable coal and 113 silt banks containing 63 million tons of recoverable coal. Samples were obtained from each of the four major anthracite fields and were used to acquire property characteristics including size, washability, and chemical data which are all included in the report. In addition, pilot preparation tests were carried out. The refuse varies considerably between samples. The report also reviews various past and current approaches to develop economic uses of coal refuse. 662.6

D68-18 COAL SPOIL HEAPS: SITE INVESTIGATION AND STABILITY ANALYSIS

Smith, G. N. (Heriot-Watt Univ., Edinburgh), Colliery Guardian 216 (5583), 585-586 (1968). The author discusses the surveys of new sites and existing refuse heaps, sampling of refuse material, and stability analysis. Standard techniques of soil mechanics can determine within reasonable limits present stability of a refuse heap, but there is little knowledge available as to how to predict long term stability. D227

D68-19 SPOIL TIP MANAGEMENT

Revised Ed. National Coal Board, Great Britain, Feb. 1968. 71 pp. This report contains examples of tip and lagoon failures and their causes. A section discusses coal preparation and refuse. Information on technical and operational control of spoil tips is extensive, with many diagrams illustrating subsidence factors, stability, and rock slip problems. D87

D68-20 FLOTATION RECOVERY OF PYRITE FROM BITUMINOUS COAL REFUSE

Sun, S. C. and Savage, K. I. (Pa. State Univ.), Trans. AIME 241, 377-384 (1968). This process, designed to recover coal, clays and pyrite from coal wastes, consists of fine grinding followed by coal and pyrite flotation which leaves the clays in the flotation pulp. A coal refuse containing 10% sulfur and 30% carbonaceous material was treated by this method to yield a coal product containing 4% sulfur, 10% ash; a pyrite product containing 45% sulfur (84% FeS_2), 1% carbonaceous material; and a clay product 2% sulfur (3.5% FeS_2). The coal yield was about 84%. The pyrite yield was about 77%. (From authors' abstract) D152

D68-21 THE ECONOMIC FACTORS OF MINERAL WASTE UTILIZATION

Vogely, W. A. (U.S. Bur. Mines), Proc. First Miner. Waste Utilization Symp., Chicago, Ill., by U.S. Bur. Mines and IIT Res. Inst., 1968. pp 7-19. Anthracite and bituminous coal mine wastes are among the wastes discussed. The amounts of wastes generated, conservation issues, and social costs are some of the factors considered. 622 M6

D68-22 THE EFFICIENCY OF PNEUMATICALLY STOWED FACES IN THE GERMAN, FRENCH AND BELGIAN COALMINING INDUSTRY

Voss, K. H., Glückauf, July 4, 1968. p 609. National Coal Board Translation A.2715/HSH. Different mining conditions in the various areas lead to different mining practices. The advantages and disadvantages of caving and pneumatic stowing are discussed. A number of ways to improve the efficiency of pneumatic stowing revealed by a 1967 survey of 80 faces in these three countries are discussed. D232

1969

D69-1 COAL RECLAMATION FROM WASTE HEAPS

Mining Miner. & Engr. 5 (4), 41-42 (1969). The Alexander Russell Group at Gartshore Dunbartonshire, England plans to reclaim spoil tip material adjacent to a former Gartshore Colliery. The pile contains 2,600,000 tons and will require six years to process. The waste material will be converted to lightweight aggregate by the same firm and several sizes of reclaimed coal will be sold. D170

D69-2 WASTE DISPOSAL COSTS AT TWO COAL MINES IN KENTUCKY AND ALABAMA

Danielson, V. A. and White, D. H., U.S. Bur. Mines, IC 8406 (1969). 28 pp. Costs of the existing waste disposal systems at each mine were estimated using present-day costs of equipment and labor. Costs of waste disposal systems using alternate equipment were also estimated. Although total disposal costs were essentially the same for both operations, reclamation costs will differ because of different reclamation practices. (From authors' abstract) BurM

D69-3 PREPARATION PLANT WATER CONTROL AND REFUSE DEWATERING SYSTEMS

Emmett, R. C., Jr. and Dahlstrom, D. A., Mining Congr. J. 55 (12), 32-40 (1969). Preparation plant water circuits are as critical as the beneficiation flowsheet in influencing results, yields, capital and operating costs. This is a very detailed article including process diagrams and equipment pictures outlining all phases of material handling. Emphasis is on economical ways to provide clean water. Jour

D69-4 DISPOSAL OF SOLID WASTES FROM COAL MINING IN WASHINGTON, OREGON, AND MONTANA

Geer, M. R., U.S. Bur. Mines, IC 8430 (1969). 39 pp. Location, amount, character, and condition were determined, and both economic and environmental factors were considered. Areas covered by waste comprise 800 acres in Washington, 5 acres in Oregon, and 1,200 acres in Montana. In a few cases waste is being utilized, particularly cinder from burned refuse dumps, as fill in road construction and as a ceramic raw material. (From author's abstract) D92

D69-5 UTILIZATION OF COAL DUST SLURRIES

Hollinger, R. H., The Franklin Inst. Res. Laboratories, Tech. Rept. to U.S. Bur. Mines, Contract 14-09-0070-380 (Feb. 1967 - June 1969). 26 pp.+ This work was done to evaluate the use of 100 mesh coal dust as a partial replacement for sand in making concrete blocks. Improvement in water resistance resulted and acceptable compressive strengths were obtained. Much of the batch equipment would not work with the coal formula so hand work was required. An extensive economic study, included as Appendix II, discusses the cost of grinding the coal product and screening. The economic study limited coal haulage distance to 45 miles. D28

D69-6 MODERN APPROACH TO PLANT REFUSE DISPOSAL

Hummer, E. D. (U.S. Steel Corp.), Coal Age 74 (6), 75, 76, 81 (1969). This article outlines requirements for an efficient disposal system. Eight factors are listed as key considerations. Diagrams show stacking, contouring and compacting practices. A section is also included on handling fine refuse. Jour

D69-7 CONSOLIDATION COAL COMPANY'S ACHIEVEMENTS IN ENVIRONMENTAL CONTROL

Karkaria, N. J. (Consolidation Coal Co.), Mining Congr. J. 54 (9), 46-51 (1969). Pictures of the Pocahontas Fuel Division's reclamation program at the Lynco Preparation plant area show stages of the restoration including views of the refuse dump before reclamation, grading in progress, terracing and planting. Similar projects at Harmar Mine and Pittsburgh Coal Co. plant near McMurray, Pa. and the Cadiz area of Hanna Coal are described. Jour

D69-8 A METHOD FOR DETERMINING THE PARTITION CURVE OF A COAL WASHING PROCESS

Luckie, P. T., Spicer, T. S., and Lovell, H. L. (Dept. Miner. Prep.), The Pa. State Univ., Spec. Res. Rept. to Pa. Coal Res. Bd., SR-70 (1969). 159 pp. This work was done to develop statistically a partition curve of a coal working process. The original data is determined by float and sink tests giving the various separation figures which are then used in a computer analysis. 662.6 P4

D69-9 RECENT ADVANCES IN EXTINGUISHMENT OF BURNING COAL REFUSE BANKS FOR AIR POLLUTION REDUCTION

Maneval, D. R. (Pa. Dept. Mines Miner. Ind.), ACS Div. Fuel Chem. Preprints 13 (2), 27-41 (1969). The history of the problem of burning coal banks is presented. A number of different techniques are discussed and it is noted that because of variation of conditions from bank to bank varying success is obtained with different methods of fire control. ACS 51F

D69-10 PENNSYLVANIA ANTHRACITE REFUSE: A SURVEY OF SOLID WASTE FROM MINING & PREPARATION

McCartney, J. C. and Whaite, R. H., U.S. Bur. Mines, IC 8409 (1969). 77 pp. The Bureau of Mines surveyed refuse banks in the anthracite area of Pennsylvania and found 863 banks occupying a total area of about 19 square miles. Most of these were located within 2 miles of the traffic centers of communities having a population of 625,000. Twenty-seven banks are burning, causing considerable distress in certain communities. Many tables, maps, and diagrams outline the scope of this survey. BurM

D69-11 OPERATION RED DOG. A STUDY OF FLUID-BED COMBUSTION AND POTENTIAL USES OF ANTHRACITE CULM-BANK MATERIAL

Dorr-Oliver Inc., Rept. to U.S. Office Coal Res. and Pa. Dept. Mines Miner. Ind., R&D Rept. 42 (Period of Performance Aug. 1966-April 1969). 118 pp. This report presents results and conclusions of bench-scale fluid-bed combustion of anthracite refuse for removal of carbon and sulfur from the solid residue. The calcined refuse was tested for use as material in highway construction and brickmaking. A schematic pilot plant layout is presented consisting of crushing, screening, fluid-bed combustion, dust collection and gas scrubbing equipment for a 0.5 tph operation. Economic

D69-11 (continued)

evaluation of an envisioned commercial refuse-combustion brickmaking facility is presented, based on use of a single 32 ft ID fluid-bed reactor for combustion of 735 tpd of 17 percent carbon anthracite refuse. Possible use of Marvine culm-bank anthracite refuse in soil-bituminous construction and Taylor culm-bank calcined refuse as soil-cement have been indicated by exploratory testing. Extraction and economic recovery of such minor constituents as germanium, lithium, vanadium, and uranium, and a major constituent, alumina do not appear feasible at present. (From author's abstract) OCR D7

D69-12 CONTROL OF POLLUTION FROM COAL MINE REFUSE SITES AND SLURRY PONDS

Ramsey, J. P. (Truax-Traer Coal Co.), AIME Fall Meet., Salt Lake City, Utah, Sept. 17-19, 1969. Preprint No. 69-F-330. 4 pp. The demonstration project near DuQuoin, Ill. where a refuse site and slurry lagoon will provide basic data for water pollution control and refuse pile reclamation is described. AIME

D69-13 THE SCOTS ARE THRIFTY

Singhal, R. K., Coal Mining Process. 6 (12), 45-47 (1969). In processing colliery waste at the Gartshore plant near Twechar northeast of Glasgow, Scotland coal and a usable shale are recovered. The shale is used in an adjoining plant in manufacturing lightweight aggregate and building blocks. Dense media processing results in sharp separation of shale and coal. A detailed flow diagram is given. D239

D69-14 UNDERGROUND DISPOSAL OF SLURRIED WASTES

Stinson, D. L., Natural Resour. Res. Inst., Univ. Wy., College Eng., Rept. to U.S. Bur. Mines, April 1969. 22 pp. This report describes underground injection using slurries of sand and of clay. It is suggested that it would be a method of disposing of coal preparation plant wastes among others. D40

1970

D70-1 A METHOD FOR EXTINGUISHING AND REMOVING BURNING COAL REFUSE BANKS

Andreuzzi, F. C., U.S. Bur. Mines, IC 8485 (1970). 29 pp. The most effective method used in the demonstration project was water quenching to a workable depth, then ripping and removing quenched material. BurM D36

D70-2 UTILIZATION OF COAL MINING WASTES

Charmbury, H. B., Proc. Second Miner. Waste Util. Symp., Chicago, Ill., by U.S. Bur. Mines and IIT Res. Inst., 1970. pp 225-227. In this

D70-2 (continued)

presentation, the author discusses previous handling of coal refuse, present practice and the future of refuse disposal. 622 M6

D70-3 COAL MINES WITHOUT WASTE HEAPS. UNDERGROUND STOWING METHOD IN POLAND

Mining Miner. Eng. 6 (7), 12 (1970). At the Brzeszcze mine in Poland worked out sections are being filled from waste heaps of rock so that the surface heaps are diminishing instead of increasing as more coal is mined. A new machine is used to crush the rock and pneumatically stow it. Waste material from processing and coal washing plants is also disposed of this way by the equipment which operates underground. D161

D70-4 U.K. PLANT INTEGRATES LIGHTWEIGHT AGGREGATE WITH BLOCK

Cook, P. B., Rock Products 73, 64-66 (1970). The integrated operation of Aglite Ltd., Twechar, Dunbartonshire, Scotland is described. Coal is reclaimed from an old refuse dump and the residue is processed into lightweight aggregate which is used at the same site for production of concrete blocks. D271

D70-5 A THERMOPHILIC ACIDOPHILIC MYCOPLASMA ISOLATED FROM A COAL REFUSE PILE

Darland, G. (1), Brock, T. D. (1), Samsonoff, W. (2), and Conti, S. F. (2), [(1) Indiana Univ., Bloomington and (2) Univ. Ky.], Science 170, 1416-1418 (1970). This paper deals with the discovery of a thermophilic acidophilic procaryote lacking a cell wall which has been found in a coal refuse pile. The organism was able to reproduce by budding. Temperature optimum was found to be 59 C. Growth occurs over a range of 45 to 62 C. No growth occurs at 37 or at 65 C. Optimum pH for growth is between 1 and 2. (From authors' abstract) D103

D70-6 AN APPRAISAL OF THE UTILIZATION POTENTIAL OF COLLIERY WASTE

Gibson, J., Mining Miner. Eng. 6 (11), 28-29, 32-33, 42 (1970). The uses described are those in highway construction, in making skid resistant road surface dressing, as concrete or lightweight aggregate, in mineral wool, and as binder and filler for plastics. Fluidized combustion is discussed as a method of disposing of colliery waste. D228

D70-7 MINING AND MILLING WASTE DISPOSAL PROBLEMS - WHERE ARE WE TODAY?

McNay, L. M. (U.S. Bur. Mines), Proc. Second Miner. Waste Utilization Symp., Chicago, Ill., by U.S. Bur. Mines and IIT Res. Inst., 1970. pp 125-130. Coal refuse disposal is one of the waste problems discussed. Bank stability, air pollution, land use conflict, and coal recovery are reviewed in detail. The four references all are on coal refuse. 622 M6

D70-8 LIQUID CARBON DIOXIDE USED TO EXTINGUISH A GOB FIRE IN A GERMAN COAL MINE

Rice, G. S. and Hartmann, I., U.S. Bur. Mines, IC 6970 (Nov. 1970). 5 pp. A method of extinguishing a mine fire in a refuse filled area in a German mine is described. The report first appeared in Glückauf p. 383, Apr. 24, 1937. Liquid carbon dioxide under high pressure was forced into the gob. BurM

D70-9 OPERATION ANTHRACITE REFUSE

Spicer, T. S. and Luckie, P. T. (Pa. State Univ., Dept. Miner. Prep.), Proc. Second Miner. Waste Util. Symp., Chicago, Ill., by U.S. Bur. Mines and IIT Res. Inst., 1970. pp 195-204. This paper describes Operation Anthracite Refuse, a research assault seeking to establish approaches and capabilities for utilizing and/or disposing of anthracite refuse by determining the characteristics, methods of beneficiation and economic value of current and in site refuse. It covers the initial phase of the research program upon this major solid material waste problem facing northeastern Pennsylvania, discussing the history, nature, magnitude, and potential solutions to the problem. (Authors' abstract) 622 M6

D70-10 SPOIL HEAPS AND LAGOONS

National Coal Board, Great Britain, Technical Handbook, Second Draft, Sept. 1970. 232 pp. Technical information presented provides the background for government regulations concerning the establishment and maintenance of refuse disposal areas. Factors affecting refuse pile stability and causing refuse pile fires are discussed in detail. Directions are given for reclaiming refuse disposal areas and for designing and constructing new refuse disposal sites and lagoons. D96

D70-11 UTILIZATION OF MINING AND MILLING WASTES

Sullivan, G. D., Proc. Second Miner. Waste Util. Symp., Chicago, Ill., by U.S. Bur. Mines and IIT Res. Inst. 1970. pp 215-219. Coal wastes are one of the mining and mineral wastes discussed. 622 M6

D70-12 PREVENTION OF ACID MINE DRAINAGE: SILICATE TREATMENT OF COAL MINE REFUSE PILES

Walitt, A., Jasinski, R., Keilin, B., and Gruber, A. (Tyco Lab., Inc.), Third Symp. Coal Mine Drainage Res., Pittsburgh, Pa., by Coal Ind. Advisory Comm. to ORSANCO (1970). 17 pp. This paper is based on studies carried out for EPA, Water Quality Office and published as "Silicate Treatment for Acid Mine Drainage Prevention," Water Pollution Control Research Series 14010 DLI 02/71. 70-109

1971

D71-1 THERMAL PROPERTIES OF COAL-CLEANING WASTES

Agroskin, A. A., Goncharov, E. I., and Yakunin, V. P., Coke and Chem., U.S.S.R. No. 7, 8-11, 1971. This article evaluates coal cleaning wastes by measuring thermophysical properties of coal wastes, determining maximum effective specific heat values, and other thermal characteristics such as thermal conductivities. Jour

D71-2 METHODOLOGY FOR THE CHARACTERIZATION OF ANTHRACITE REFUSE

Augenstein, D. and Sun, S. C. (Dept. Miner. Prep.), The Pa. State Univ., Spec. Res. Rept. to Pa. Dept. Environ. Resour., SR-86 (1971). 77 pp. The object of this work was to develop the methodology necessary for examining the physical and compositional characteristics of anthracite coal refuse with the aid of a device to remove organic material at temperatures well below 200 C without altering the original minerals; sample and analyze refuse from the several old banks in the anthracite region and from two operating plants; and to examine the nature of occurrence of minerals in refuse by analysis of different size and gravity fractions. (From Introduction) 662.6 P4

D71-3 POLLUTION CONTROL OF PREPARATION PLANT WASTES - - A RESEARCH AND DEMONSTRATION PROJECT

Barthauer, G. L. (Consolidation Coal Co.), AIME Environ. Quality Conf., Washington, D.C., June 7-9, 1971. Paper EQC 38. 14 pp. This project was carried out in Southern Illinois to demonstrate a practical way to abate pollution from coal mine preparation plant wastes. The refuse pile had approximately 40 acres and a slurry lagoon of about 50 acres. Project was divided into 2 parts: (1) determination of acid formation rate; (2) remedial procedures. 71-80

D71-4 CONTROL OF MINE DRAINAGE FROM COAL MINE MINERAL WASTES. PHASE I -- HYDROLOGY AND RELATED EXPERIMENTS

Barthauer, G. L., Kosowski, Z. V., and Ramsey, J. P., Truax-Traer Coal Co., Rept. to EPA, Office Res. Monit., Water Pollut. Contr. Res. Ser. 14010 DDH 08/71 (1971). 148 pp. NTIS, PB-206 194. The characteristics and acid formation rate of a refuse pile covering 40 acres are reported. A number of vegetative covers were used and evaluated for reducing acid pollution. D115

D71-5 FIRES IN COAL MINING WASTES: A REVIEW OF CAUSES, PROCEDURES, LEGISLATION AND POLLUTION

Campbell, A. R., Proc. Australian Waste Disposal Conf. 1971. Paper No. 17. pp 87-92. Among the subjects discussed are the influence of mining and marketing methods on amount of refuse, prevention and control of refuse fires, and regulation of refuse disposal of New South Wales, Great Britain and Pennsylvania. D328

D71-6 DEMONSTRATION OF A TECHNIQUE FOR LIMITING THE SUBSIDENCE OF LAND OVER ABANDONED MINES

Candeub, Fleissig and Assoc., Tech. Rept. to U.S. Dept. HUD, June, 1971. 65 pp.+ NTIS PB-212 708. This Technical Report gives the detailed description of the Rock Springs, Wyoming area and the demonstration of the closed system hydraulic backfill developed by Dowell Div., Dow Chemical Company. D359

D71-7 BEAUTIFICATION OF ANTHRACITE REFUSE

Charmbury, H. B., Bergman, E. L., and Chubb, W. R. (Pa. State Univ.), AIME Ann. Meet., Feb. 21, 1971. 14 pp. In the program conducted to find ways to revegetate anthracite refuse piles, poultry manure was used as successfully as lime fertilizer. Kentucky Bl, creeping fescue, and in some cases crownvetch were hydroseeded on anthracite spoil bank material, refuse banks, silt basin refuse, and incinerated refuse. Mulch was used in some cases. Only one plot did not support germination and growth and it was assumed that the particle size of the soil was too large to retain moisture well. D122

D71-8 CROSSFLOW SCREENS, CYCLONES, AND CENTRIFUGES

Coal Mining Process. 8 (9), 52-55 (1971). This article describes the preparation facilities and material handling procedures at the Universal mine of Peabody Coal Co. The plant gets maximum recovery of both clean coal and refuse down to 1/4 mm size in jig washing. The refuse slurry circuit and other equipment in the preparation plant are described. R134

D71-9 COLLIERY WASTE DISPOSAL PROBLEMS

Currie, G. A., Barnsley and Dist. Min. Soc. Trans. 22, 47-52 (1971-72). The preparation of a code of practice for the construction of spoil heaps and lagoons is discussed. D58

D71-10 PRELIMINARY REPORT OF WATER QUALITY MEASUREMENTS AND REVEGETATION TRIALS ON MINED LAND AT LUSCAR, ALBERTA

Etter, H. M., Canadian Forestry Service, Northern Forest Research Centre, Edmonton, Alberta, Internal Rept. NOR-3, Aug. 1971. 19 pp. This report concerns a project around the Camp, Cabin, and Luscar Creeks in the Upper Foothills of western Alberta, Canada. The project involved water sampling and testing in addition to a revegetation by hydroseeding on weathered sandstone and shale overburden. Five seed mixtures were used and a tabulation gives the grasses and legumes and their maximum expected number of germinants. Several sketches and diagrams show the location and position of the test areas. A detailed tabulation of the water sample analyses is also given. Sediment, including coal particles, was also monitored. 71-107

D71-11 THE PREVENTION AND CONTROL OF BURNING IN WASTE COAL DUMPS

Flann, R. C. and Lukaszewski, G. M. (SCIRO, Div. Miner. Chem.), Proc. Aust. Inst. Min. Met. 238, 11-29 (June 1971). Under Australian conditions the

D71-11 (continued)

technique recommended for control of existing dump fires, based on experimental work, is to spray the dump with a chemical fire retardant, to cover the dump with a suitable soil, and to seal the surface with a 1 percent solution of aluminum sulfate or sodium metasilicate. The recommended method of dump construction to prevent fires is to level and seal the site, to construct a firebreak around the dump area, and to build a rectangular dump with minimum size segregation and compacted surfaces. (From authors' abstract) D255

D71-12 COAL MINE REFUSE DISPOSAL IN GREAT BRITAIN

Glover, H. G. (Visiting Prof. Miner. Sci.), Pa. State Univ., Spec. Res. Rept. to Pa. Dept. Environ. Resour., SR-81 (1971). 33 pp. This report describes treatment of the problem in Great Britain outlining types of refuse, current refuse disposal to banks, utilization, alternate disposal, current research and mineral preparation. 662.6 P4

D71-13 CRUSHING ANTHRACITE REFUSE

Greenlee, J. K. and Spicer, T. S. (Dept. Miner. Eng.), The Pa. State Univ., Spec. Res. Rept. to Pa. Dept. Environ. Resour., SR-87 (1971). 67 pp. The purpose of this study was to determine how much it costs to crush anthracite refuse to sizes that can be used. The scope has been limited to size reduction from 3 feet to 1/2 inch which is considered primary and secondary crushing. The effects on the costs of the characteristics of material to be crushed and the crusher used have also been investigated. 662.6 P4

D71-14 THAT REFUSE DISPOSAL PROBLEM

Jones, D. C., Coal Mining Process. 8 (10), 42-49 (1971). This is a survey of methods used in the collection of preparation plant refuse and covers disposal by trucks, conveyors, aerial tramways and hydraulic methods. Problems associated with storage piles as well as their economic potential are also discussed. R135

D71-15 LANDSCAPE RECLAMATION: A REPORT ON RESEARCH INTO PROBLEMS OF RECLAIMING DERELICT LAND

Research Team, University of Newcastle upon Tyne, IPC Science and Technology Press Ltd., Guildford, Surry, England, Vol. 1, 1971. 135 pp. Vol. 2, 1972. 85 pp. Most of the material in these volumes deals with reclaiming coal refuse piles. The problem in Great Britain is outlined and details of a number of specific projects are reported. Drainage, revegetation, removal of and/or regrading of refuse piles, legal aspects, and costs of the work are all considered. D430

D71-16 CARBONATE BONDING OF COAL REFUSE

LaRosa, P. J., Karnavas, J. A., and Pelczarski, E. A., Black Sivalls and Bryson, Inc., Rept. to U.S. EPA, Water Qual. Office, Water Pollut. Contr.

D71-16 (continued)

Res. Ser. 14010 FOA 02/71 (1971). 44 pp. Both bituminous and anthracite refuse were treated with water and lime hydrate and carbon-dioxide rich gas to form a material which was tested for feasibility as a construction material and as a coal refuse pile sealant. D104

D71-17 STUDY OF SULFUR RECOVERY FROM COAL REFUSE

LaRosa, P. J. and Michaels, H. J. (Black, Sivalls & Bryson, Inc.), U.S. EPA Water Quality Office, Water Pollut. Contr. Res. Ser. 14010 FYY 09/71 (1971). 67 pp. Feasibility study was made on a process producing sulfur from coal refuse. Limestone and coal refuse were ground, pelletized, and preheated before entering desulfurizing shaft reactor which produced a hard, fired ash pellet and H_2S-SO_2 bearing off gas. After sulfur, tar and other gases are removed, the H_2S-SO_2 gas goes to a conventional sulfur recovery plant. 71-59

D71-18 PENNSYLVANIA CLEANS UP ITS ANTHRACITE FIELDS

Maneval, D. R., Mining Eng. 23, 57-60 (1971). The author compares operations of anthracite mining in early days with the regulated practices of the present day. Several methods used to extinguish refuse bank fires are also described. D277

D71-19 INVESTIGATION OF THE HALDEX (SIMDEX) PROCESS FOR BENEFICIATING COAL REFUSE: HUNGARIAN PRACTICE - 1969

McLean, D. C., Kogelmann, W. J., and Spicer, T. S. (Dept. Miner. Prep.), The Pa. State Univ., Spec. Res. Rept. to Pa. Dept. Environ. Resour., SR-80 (Mar. 31, 1971). 30 pp. In a field trip to Tatabanya, Hungary, information was obtained on the Haldex (Simdex) Process for recovering fine coal from refuse. This heavy media process, which uses a specially designed horizontal cyclone, is illustrated by flow sheets. Fine coal recovery plants in the United States and Great Britain are also described. 662.6 P4

D71-20 COAL REFUSE FIRES AN ENVIRONMENTAL HAZARD

McNay, L. M., U.S. Bur. Mines, IC 8515 (1971). 50 pp. Bureau of Mines located and examined 292 burning coal refuse banks throughout the nation's coal-producing regions in 1968. These coal waste fires extending over 3,200 acres produce poisonous, acrid gases and particulate matter that pose a threat to health and safety in the surrounding areas. Methods of extinguishing coal refuse fires are discussed and an approach to eliminating future occurences of these fires is presented. (From author's abstract) BurM

D71-21 MINE REFUSE PILE COVERINGS TO REDUCE WATER PERCOLATION

MSA Research Corp., Summary Rept. to Pa. Environ. Resour. Admin., 1971. 32 pp. Five materials were evaluated as potential mine refuse pile covers: urethane foam, polyethylene sheeting, linseed oil, fly ash,

D71-21 (continued)

and polyvinyl chloride. These materials were placed on refuse piles and checked for weathering and water permeability over a 15 month test period. D79

D71-22 NCB (PRODUCTION) CODES AND RULES - TIPS, FIRST DRAFT

National Coal Board, Great Britain, 1971. 82 pp. This publication contains all the regulations pertaining to the handling and recording of refuse material in England. The contents are as follows: I. Introduction, II. General Regulations Relating to Tips, III. Regulations Relating to Active Classified Tips, IV. Regulations Relating to Closed Classified Tips, V. Regulations Relating to Resumption of Tipping Operations at Closed Tips, VI. Miscellaneous Regulations, and VII. NCB Requirements for Unclassified and Disused Tips. The appendix contains regulations for reporting tip inspections. D89

D71-23 ECTOMYCORRHIZAL ESTABLISHMENT AND SEEDLING RESPONSE ON VARIOUSLY TREATED DEEP-MINE COAL REFUSE

Nicholas, A. K. and Hutnik, R. J. (School Forest Resour.), The Pa. State Univ., Spec. Res. Rept. to Pa. Dept. Environ. Resour., SR-89 (1971). 121 pp. In greenhouse tests, European white birch and red pine were grown with three different bituminous spoils, three levels of fungal symbiont, two levels of lime treatment, and two levels of fertilization treatment. The results are promising enough to encourage further studies, especially field plantings. Application of fertilizer, and of lime where needed, is recommended with any plantings on refuse banks. 662.6 P4

D71-24 UTILIZATION OF COLLIERY WASTE IN THE BUILDING AND CONSTRUCTION INDUSTRIES AND IN AGRICULTURE

Nicholson, S. R., Mining Miner. Eng. 7 (3/4), 27-28 (1971). This paper was given at the National Meeting of the Minerals Engineering Society at Nottingham University, Sept. 1970. Utilization of colliery waste in England has always been of some interest in agriculture and building and construction industries. The various uses come under the following headings (1) utilization in its natural form (2) utilization of burnt shale (3) utilization in manufactured building materials. The article describes in considerable detail how the materials are used and gives many examples. D120

D71-25 PENNSYLVANIA ANTHRACITE REFUSE. A SUMMARY OF A LITERATURE SURVEY ON UTILIZATION AND DISPOSAL

Spicer, T. S., Pa. State Univ., Spec. Res. Rept. to Pa. Coal Res. Bd., SR-79 (1971). 43 pp. The literature references are divided into thirteen categories, each introduced by a discussion of the subjects covered. 662.6 P4

D71-26 PENNSYLVANIA ANTHRACITE REFUSE - A LITERATURE SURVEY ON CHEMICAL ELEMENTS IN COAL AND COAL REFUSE

Sun, S. C., Vasquez-Rosas, H., and Augenstein, D., The Pa. State Univ., Spec. Res. Rept. to Pa. Dept. Environ. Resour., SR-83 (1971). 72 pp. The purpose of this work was to learn the composition of anthracite refuse and the possible extraction of some components as an aid to refuse disposal. The 245 references pertain to all ranks of coal. 662.6 P4

D71-27 ENVIRONMENTAL CHARACTERISTICS AFFECTING PLANT GROWTH ON DEEP MINE COAL REFUSE BANKS

Thompson, D. N. and Hutnik, R. J. (School Forest Resour.), The Pa. State Univ., Spec. Res. Rept. to Pa. Dept. Environ. Resour., SR-88 (1971). 81 pp. This study revealed all the environmental problems which afflict plants and other vegetation on spoil banks. Slopes are steep, unstable, of varied texture much of it coarse and unable to hold satisfactory moisture. Surface temperatures are usually above the critical temperature 122 F. Chemical analyses show extreme nutrient deficiencies and toxic levels of aluminum and iron. Although nitrogen was present it was in forms not available to plants. 662.6 P4

D71-28 SILICATE TREATMENT FOR ACID MINE DRAINAGE PREVENTION

Tyco Lab., Inc., Rept. to EPA, WQO, Water Pollut. Contr. Res. Ser. 14010 DLI 02/71 (1971). 94 pp. NTIS, PB-198 427. A laboratory study was carried out on actual mine refuse to evaluate the effectiveness of silicate-based gels to prevent acid drainage from coal mine refuse piles. Alumina-silica gel applied so that the gel penetrated the pile up to 6 inches was most effective. Acid drainage formation was retarded by neutralization by the treatment materials as well as by coating of the pyritic refuse. However, treatment of acid mine water by sodium silicate and sodium aluminate was no more effective than conventional lime treatment. Although weathering tests showed that the gels were affected by extremes of temperature, washings of weathered test materials showed that residual alumina and silica maintained effectiveness for an equivalent of 120 inches rainfall. 71-9

1972

D72-1 COAL MINE SPOIL AND REFUSE BANK RECLAMATION WITH POWERPLANT FLY ASH

Adams, L. M., Capp, J. P., and Gillmore, D. W. (U.S. Bur. Mines), Proc. Third Miner. Waste Util. Symp., Chicago, Ill., by U.S. Bur. Mines and IIT Res. Inst., 1972. pp 106-111. The field treatments of surface mine spoil in a long-range combination field and greenhouse study are emphasized. Benefits of reclaiming both surface mine spoil and coal mine refuse include partial neutralization of acid spoil and refuse materials; increase in moisture holding capacity and pore space of moisture holding materials; yields of forage that compared favorably with yields from undisturbed pastures and fields; use of large amounts of fly ash. Information

D72-1 (continued)

tabulated includes composition of fly ash used, chemical analysis of surface mine spoil at treated sites, and costs of reclamation. 622 M6

D72-2 REPORT ON VEGETATION OF COAL MINE REFUSE

Balsinger, T. R. (Silviculturist, Ebensburg, Pa.), Letter to Environ. Qual. Contr. B., Pa. Dept. Environ. Resour., Nov. 15, 1972. 3 pp. Two reports are attached to this letter. In one, "Mine refuse-experimental planting plots," 2 pp., the preparation of two plots of refuse with lime, fertilizer, and seed is described. One plot was treated with an acid sensitive chemical sealer and one was not. The other report, "Coal mine refuse disposal seeding project," 2 pp., discusses the sealer and methods of applying it. Pictures in color show the difference in vegetation. D61

D72-3 RECLAIMING AN UNSIGHTLY REFUSE PILE

Barthauer, G. L., Parks and Recreation _7_ (2), 25, 36 (1972). The reclamation of the refuse disposal area at the New Kathleen Mine, DuQuoin, Ill. is described. CE297

D72-4 ENVIRONMENTAL ACTION PROGRAMS FOR NORTHEASTERN PENNSYLVANIA: REFUSE BANK REMOVAL, SUBSIDENCE MONITORING

Bee, R. W., _et al_. MITRE Corp., Tech. Rept. to U.S. Bur. Mines, MTR-6165 (April 1972). 227 pp.+ NTIS, PB-214 535/7. The refuse removal task consisted of developing a methodology for selecting the most economical combinations of coal mine breaker refuse and rock banks, disposal sites and material moving systems. To prepare plans for moving refuse in the Lackawanna Valley, refuse banks were inventoried, underground disposal sites identified and unit cost data prepared for the various material moving systems. The subsidence monitoring task consisted of defining the phenomenon of coal mine induced surface subsidence, establishing operational requirements, cataloguing sensors and techniques to detect and measure subsidence and testing of the most promising of these techniques. (From authors' abstract) 631 M684

D72-5 BUFFALO CREEK BRINGS NEW REQUIREMENTS

Coal Age _77_ (4), 18, 20, 22 (1972). This article describes details of a report filed by the Interior Dept. investigating the Buffalo Creek disaster. Recommendations say each mine or plant should file a 10-20 yr plan of its waste disposal systems. Jour

D72-6 THE BUFFALO CREEK DISASTER

Coal Age _77_ (3), 40 (1972). This news item with a picture describes the Buffalo Creek dam failure February 26, 1972. Jour

D72-7 BUFFALO CREEK (W. VA.) DISASTER, 1972

Senate Hearings - Part I, Appendix A; Part 2, Appendixes B, C, and D, 1972. 2717 pp. The contents include verbatim testimony of witnesses, formal statement, and related publications giving additional information. Hearings

D72-8 THE UTILIZATION OF INCINERATED ANTHRACITE MINE REFUSE AS ANTI-SKID HIGHWAY MATERIAL

Charmbury, H. B. (1) and Maneval, D. R. (2) [(1) The Pa. State Univ. (2) Appalachian Regional Comm.], Proc. Third Miner. Waste Util. Symp., Chicago, Ill., by U.S. Bur. Mines and IIT Res. Inst., 1972. pp 123-129. Anthracite refuse material from piles which had been burning was crushed and screened and tested as a highway anti-skid material. Tests were conducted on all kinds of roads and satisfactory performance resulted. This project was an outgrowth of the State's environmental efforts to extinguish many of the burning anthracite refuse piles in northeastern Pennsylvania. The State is now developing a specification for this product which will then place it on the bidders lists. The specific test material was prepared from the 13 million ton refuse bank of the Huber Colliery at Ashley, Pennsylvania. 622 M6

D72-9 COAL MINING COMPANY BUILDS NEW LAND FROM REFUSE PILES

Coal Age 77 (4), 118-119 (1972). This article describes Bethlehem Mines Corp. land reclamation near the community of Idamay, Marion County, West Virginia. The company now owns 100 acres of which 60 acres are revegetated and leveled land that was formed from a refuse pile. D56

D72-10 CONSOL CLEANING UP COAL REFUSE PILES

Consol News 11 (1), 6-7, 9 (May-June 1972). Reclamation at the Pocahontas Fuel Company Division is described and illustrated. D351

D72-11 SUPPRESSION AND PREVENTION OF FIRES IN COAL REFUSE HEAPS

Cudmore, J. F. and Cremer, L., Australian Coal Industry Res. Lab. Ltd., P.R. 72-4, June 1972. 32 pp.+ This report summarizes experimental work carried out to suppress an active heating in a portion of a refuse dump at a location in the South Maitland Coal Field of New South Wales. Both heat dissapation and fire suppression were achieved at the test site by employing the principle of evaporative cooling. This effect was accomplished by pumping water into sub-surface hot zones through a system of probes inserted into the dump for this purpose. Additional treatment included the capping of the smoke emission zone by a layer of ash and clinker produced on-site and surface spraying to reduce the concentration of gaseous pollutants. (From authors' summary) 662.6 A9

D72-12 DEEP COAL MINING AND THE ENVIRONMENT

Currie, W. J. (Natl. Coal Bd.), Colliery Guardian Ann. Rev., 56-64, Oct. 1972. The present situation in British coal mining is reviewed, including handling of coal refuse and reclaiming of land by removal of refuse piles. Jour

D72-13 A DAM IN NAME ONLY BLAMED FOR DISASTROUS FLOOD

Eng. News Rec. 188 (9), 10 (1972). This is an account of the Buffalo Creek Dam failure as explained by the U.S. Corps of Engineers who had the job of repairing much of the creek damage. D49

D72-14 METHOD OF SUBSIDENCE AND ACID ENTRAINED DRAINAGE CONTROL AND ADMIXTURES THEREFOR

Davis, W. A. (to Michael L. Vongrey, Jr., Kittanning, Pa.), U.S. Pat. 3,704,594 (Dec. 5, 1972). 9 pp. One of the materials used in formulations listed to fill mine voids is coal mine refuse. 72-70

D72-15 DISASTER ON BUFFALO CREEK 1972

Report of the Citizens' Commission Investigation, 1972. 31 pp. The Citizens' Commission is made up of a number of people who were concerned that the public investigation of the Buffalo Creek disaster would be biased and so carried out their own inquiry. The membership is listed in the brochure. The Commission's findings and conclusions are presented with notes on their supportive evidence. The recommendations made include a number for citizen action as well as for government and coal company action. In the final report it is noted that Buffalo Creek raises a basic question--"whether the ownership and operation of the coal mines should be brought under democratic control to benefit all the people." D20

D72-16 UTILIZATION OF COAL MINE REFUSE

Doyle, F. J. and Chen, C. Y. (Michael Baker, Jr., Inc.), Public Hearing Coal Disposal Regulations, Environ. Qual. Bd., Pa. Dept. Environ. Resour., Harrisburg, Pa., Nov. 15, 1972. 14 pp. Some of the technological developments making possible utilization of large volumes of coal refuse, particularly as material in engineering construction and as a source of low cost fuel for power generation, are reviewed. The situation in Great Britain, where coal refuse is beginning to be widely used, is contrasted with the existing construction specifications in the United States which more or less prohibit the use of coal refuse. D105

D72-17 ENVIRONMENTAL PROTECTION - A CONSOL OBJECTIVE SINCE 1948

Coal Age 77 (10), 122-138 (1972). The overall mine drainage, reclamation and waste disposal program of Consolidation Coal Co. is described. Fifteen water treatment plants are in operation and three more in development stages. Major projects for the company include Ittman preparation plant, Hanna Coal Co. Division's reclamation program, The Pocahontas Fuel Co.

D72-17 (continued)

reclamation project and Dents Run surface and water cleanup. Two maps show the extent of the areas improved. Costs of each project are included. Jour

D72-18 FAILURE OF COAL WASTE EMBANKMENT BLAMED ON LACK OF ENGINEERING

Eng. News Rec. 188 (10), 11-12 (1972). This article describes the dam at Buffalo Creek and the events which occurred before it failed. The material used to build the dam was coal washing waste. Some alteration had been attempted when water level rose near the top. This consisted of a one foot spillway which added to the dam's instability. D48

D72-19 FEASIBILITY STUDY, LAKE HOPE MINE DRAINAGE DEMONSTRATION PROJECT

U.S. EPA, Office Res. Monitoring, Environ. Protection Technol. Ser. EPA-R2-73-151 (March 1972). 97 pp. Removal or burial of coal refuse both from active and inactive mines in the demonstration project improved the esthetics of the area and the water quality of Lake Hope. D31

D72-20 RECLAMATION OF SPOIL AND REFUSE BANKS WITH POWERPLANT FLY ASH

Gillmore, D. W. and Capp, J. P., AIME Ann. Meet., San Francisco, Calif., Feb. 20-24, 1972. Preprint No. 72-F-61. 17 pp. This paper describes the merits of fly ash as a soil conditioner for use in mined land reclamation work. The U.S. Bureau of Mines surface-mine reclamation program from 1965 through 1971 is summarized. A number of projects in which fly ash was blended with gob-pile material or spoil to achieve neutral soil are described and the physical and chemical benefits to the soil are listed. A cost study for this kind of reclamation produced a figure of $300/acre depending on a number of factors. AIME

D72-21 VARIOUS WAYS TO RECOVER COAL FINES

Halvorsen, W. J. (Consolidation Coal Co.), Coal Mining Process. 9 (10), 49, 71-72 (1972). Current practice in recovering coal fines at three plants of Consolidation Coal Co. is described. Jour

D72-22 RECLAMATION FROM COAL MINE WASTE DUMPS

Hambleton, G. C., Can. Mining Met. Bull. 65 (722), 83-93 (1972). This thorough coverage of the factors involved in recovery of coal from refuse describes projects in Canada, England and Wales. There is an extensive bibliography. Jour

D72-23 ANTHRACITE REFUSE POLLUTION AND SOCIO-ECONOMIC PLANNING IN NORTHEASTERN PENNSYLVANIA

Larkin, R. P., Peters, G. L., and Spicer, T. S. (Dept. Miner. Eng.), The Pa. State Univ., Spec. Res. Rept. to Pa. Dept. Environ. Resour., SR-90 (1972). 80 pp. This study was made to determine a plan for removing refuse piles in the anthracite region. The area is divided into four

D72-23 (continued)

separate sections each of which is described and rated by classifying each pile according to its degree of ugliness and pollution contribution. A priority sequence for refuse bank removal was then developed. Most of the data on the refuse banks came from studies by the Bureau of Mines and the Department of Mineral Industries of the Commonwealth of Pennsylvania. 662.6 P4

D72-24 LIST OF COAL WASTE BANKS

U.S. Dept. Interior, Task Force to Study Coal Waste Hazards, June 15, 1972. (Supersedes listing dated May 1, 1972). 288 pp. The list identifies 960 banks located within 20 states and gives size of each bank, its specific site, the owner, the size of any impoundment, and notes if it is burning. D329

D72-25 SITUATION REPORT ON BUFFALO CREEK

Lowman, S. G., Coal Age 77 (4), 124-131 (1972). A map shows route of flooding from Buffalo Creek dam failure. The article explains regulations now in effect and many investigations in progress. Detailed pictures show geography and resulting damage. D57

D72-26 COAL MINING VS. ENVIRONMENT: A RECONCILIATION IN PENNSYLVANIA

Maneval, D. R., Appalachia 5 (4), 10-40 (1972). Coal refuse banks in Pennsylvania, problems related to them and work toward solving the pollution they engender are all described. D337

D72-27 COARSE COAL CLEANING AT MONTEREY NO. 1 PREPARATION PLANT

Manwaring, L. G., Mining Congr. J. 58 (3), 42-48 (1972). This Monterey Coal Co. preparation plant is committed to building and operating in a manner consistent with good environmental control purposes and to being a "good neighbor." Pictures and process diagram show how efficient and attractive this installation is and the extensive effort expended to maintain proper refuse handling and water clarification. D70

D72-28 A PRELIMINARY INVESTIGATION OF SLUDGE REFUSE FROM INDIANA COAL MINES

Miller, L. V. (Ind. Geol. Surv.) Proc. Ind. Acad. Sci. 81, 246-250 (1972). Seven samples of fine refuse (sludge) were collected from two coal mine refuse pits located in Green and Sullivan Counties. Particle size distribution and proximate and ultimate analyses of the sludge refuse were determined. The data indicated that the Btu content of the refuse was about 75 percent of that of the "whole coal" on the moisture-free basis but was almost similar on the moisture-ash free basis. (From author's abstract) D332

D72-29 EFFECTIVE FILTRATION OF SHALE SLURRIES USING ROTARY VACUUM FILTERS. 1. SELECTION OF VACUUM FILTER TYPE FOR DEWATERING FLOCCULATED COAL FLOTATION TAILING SLURRIES - AN EXPERIMENTAL APPROACH

Osborne, D. G. and Robinson, H. Y., Filtration & Separation 9 (4), 397-401, 415 (July-Aug. 1972). At the University of Newcastle upon Tyne, research on dewatering coal shale having a high clay content has been carried out using rotary vacuum filters. D111

D72-30 EVALUATION OF WASTE WATERS FROM PETROLEUM AND COAL PROCESSING

Reid, G. W. and Streebin, L. E. (Norman Res. Inst., Okla. Univ.), U.S. EPA, Office Res. Monitoring, Environ. Protection Technol. Ser. EPA-R2-72-001 (Dec. 1972). 205 pp. The handling and disposal of water from coal preparation is one of the concerns of this report. 72-68

D72-31 REVIEW OF RESEARCH ON PROPERTIES OF SPOIL TIP MATERIALS

National Coal Board: Headquarters Research Project, Wimpey Laboratories Ltd., Hayes, Middlesex, England, Lab. Reference No. S/7307 (Jan. 1972). (217 pp.) Testing on coarse material from 11 collieries was carried out to determine its stability in refuse piles. Shear strength was investigated extensively including the effect of moisture content and an assessment of the extent and effect of particle size degradation by mechanical breakdown and by weathering. Information on fine material discarded as slurry or tailings was obtained at 8 lagoons. A wide range of crust conditions was found, with all lagoon deposits being soft in the upper few metres, and one being extremely soft throughout. Since coarse particles tended to build up near the inlet of lagoons a recommendation was made to move the inlet from time to time to increase the stratification of the deposit to improve drainage. D347

D72-32 A GROWING PROBLEM: FINE REFUSE HANDLING

Sisti, D. C. (Heyl & Patterson, Inc.), Coal Mining Process. 9 (10), 41-43 (1972). In recovering coal fines various combinations of froth flotation, static thickening, continuous vacuum filtration, solid bowl centrifuging and flocculation are used. Jour

D72-33 STREAMLINED REFUSE DISPOSAL

Coal Age 70 (3), 106-108 (1972). This article describes Eastern Associated Coal Corporation's new refuse disposal system at its Kopperston Preparation Plant. Handling 6000 tpd is done by twin engine trucks, conveyor belts and a 7 ft diameter steel tube connecting method. Jour

D72-34 THE GEOTECHNICAL CHARACTERISTICS OF A SPOIL HEAP AT YORKSHIRE MAIN COLLIERY

Taylor, R. K. and Spears, D. A., Quart. J. Eng. Geol. 5, 243-263 (1972). The physical and mechanical properties of samples from two boreholes

D72-34 (continued)

indicate that there is no weathering of refuse below a depth of about 3 m which represents the limit of shallow percolation. D144

D72-35 TENTATIVE DESIGN GUIDE FOR MINE WASTE EMBANKMENTS IN CANADA

Wright Engineers Limited, Golder, Brawner & Associates Limited, Ripley, Klohn & Leonoff International Limited, prepared for Canada, Dept. Energy, Mines and Resources, Mines Branch Mining Research Centre, Tech. Bull. TB145 (March 1972). 217 pp. The guide gives suggestions for dealing with the many parameters affecting the disposal of mine wastes in piles, embankments and settling ponds. Maintenance and reclamation of refuse disposal sites are also discussed. D322

D72-36 OXIDATION OF PYRITES IN CHLORINATED SOLVENTS

Troy, J. C., Boros, J. A., and Brenneman, D. R. (Cyrus Wm. Rice Div., NUS Corp.), U.S. EPA, Office Res. Monitoring, Environ, Protection Technol. Ser. EPA-R2-72-069 (Nov. 1972). 51 pp. The purpose of this study was to develop methods for extracting sulfur and iron compounds from pyrite waste materials thereby producing a refuse which will not cause water pollution. Primary method under investigation was the chlorination of pyrites in non-aqueous solvents. Successful extraction was obtained using continuous addition of chlorine to the system. (From authors' abstract) D84

D72-37 THE UTILIZATION OF ANTHRACITE REFUSE AS A SOILLESS MEDIUM

White, J. W., Chubb, W. R., and Charmbury, H. B. (Penn. State Univ.) AIME Fall Meet., Birmingham, Ala., Oct. 18-20, 1972. Preprint No. 72-B-339. 10 pp. Also published as "Anthracite refuse as a soilless medium," Mining Eng. 25 (3), 48-49 (1973). In a project supported in part by Pennsylvania Department of Environmental Resources and the U.S. Bureau of Mines, incinerated anthracite refuse was used as a soilless medium for growing greenhouse plants. Peat moss and solutions of fertilizer were added in varying amounts. Roses, azaleas and African violets were among the plants successfully grown. D324, D341

D72-38 APPRAISAL OF STREAM SEDIMENTATION IN THE SUSQUEHANNA RIVER BASIN

Williams, K. F. and Reed, L. A., U.S. Geol. Surv., Water-supply Paper 1532-F (1972). 24 pp.+ The report indicates that one reason for a downtrend in sedimentation in the main stem of the Susquehanna River is the decline of anthracite coal mining and processing in the area. D102

1973

D73-1 GOB PILE STABILIZATION IN GREAT BRITAIN

Akers, D. J., Jr. and Lawrence, W. F., W. Va. Univ., Coal Res. Bur., Rept. No. 95 (undated). 8 pp. This review of British work is based mainly on

D73-1 (continued)

the second draft of the National Coal Board Technical Handbook, "Spoil Heaps and Lagoons." D330

D73-2 ANALYSIS OF COAL REFUSE DAM FAILURE. MIDDLE FORK BUFFALO CREEK, SAUNDERS, WEST VIRGINIA

Vol. 1. Chapters I-IX, Vol. 2. Appendixes A, B, and C, W. A. Wahler and Associates, Rept. to U.S. Bur. Mines, Office Deputy Dir. Health and Safety, Feb. 1973. NTIS, PB-215 142, PB-215 143. This first volume contains a summary and conclusions of the investigation, drawn from the body of the report; pertinent information on the Buffalo Mining Company's plant and its operation; a discussion of the geologic and engineering characteristics of the Buffalo Creek area; a description of coal refuse placement in Middle Fork Valley and its effects on the probable physical characteristics of the embankments and foundations; an analysis of the postfailure appearance of the site; a discussion of the probable mode of failure of the refuse dams; and a discussion of the consequences of the resulting flood. The second volume contains basic geologic and engineering data supporting the discussions and conclusions in Volume 1. These appendixes include data developed during the field and laboratory investigations, and other supporting information. (From Organization of the Report) D159, D160

D73-3 FLY ASH ACHIEVING DRAMATIC SUCCESS IN RECLAIMING COAL WASTE PILES

Babcock, A. (Monongahela Power Co.), Coal Age 78 (4), 88-89 (1973). This article describes a number of locations where fly ash was used to condition coal waste piles which were then seeded. Results show the increase in the pH value of the reclaimed pile. Comparisons are made with the use of top soil and fertilizers and mulch. Sewage sludge was also used in one instance. Results show that 1.5 in. - 2 in. of fly ash applied to a refuse pile will do a comparable job at considerably less cost than other methods. D29

D73-4 IDENTIFICATION AND MAPPING OF COAL REFUSE BANKS AND OTHER TARGETS IN THE ANTHRACITE REGION

Borden, F. Y., Thompson, D. N., and Lachowski, H. M. (Pa. State Univ.), Symp. on Significant Results Obtained from Earth Resour. Tech. Satellite-1; Vol I - Tech. Presentation, Sect. B, NASA Rept. SP-327 (1973). pp 1067-1074. This paper describes how ERTS-1 MSS data from Pennsylvania's Southern and Eastern Middle Anthracite Coal Fields were studied to see how well coal refuse accumulations could be identified and mapped by computer analysis and processing. A nine mile square section was used for the study. The photographic coverage was quite effective in detecting differences in reflectance of refuse, mine spoil, water and reclaimed areas. The ERTS-1 data map has been found to be feasible and it also has produced additional information on the topography of refuse areas. D361

D73-5 THE SCIENCE AND ECONOMICS OF COAL PREPARATION

Cammack, P., Colliery Guardian Annual Review, Sept. 1973. pp 84-89.

D73-5 (continued)

This article on coal preparation in England includes a discussion of dewatering and disposal of the effluent solid refuse. D319

D73-6 DEMONSTRATION OF A TECHNIQUE FOR LIMITING THE SUBSIDENCE OF LAND OVER ABANDONED MINES

Candeub, Fleissig and Assoc., Final Report to U.S. Dept. HUD, Nov. 1973. 28 pp. This report describes a backfilling demonstration project conducted in the town of Rock Springs, Wyoming. Subsidence from mining had been substantial and damage which resulted is pictured. Dowell Div., Dow Chemical Company used a new technique to hydraulically place 19,500 cubic yards of sand in an injection borehole. The Bureau of Mines then experimented in other areas using crushed mine refuse. The slurry is forced through a closed system into the mine void at high velocity and the solid spreads out over a wider area and fills more of the mine than in regular hydraulic backfilling. D358

D73-7 STRIP MINE RECLAMATION IN ILLINOIS

Carter, R. P., Zimmerman, R. E., and Kennedy, A. S., Argonne National Laboratory, Energy and Environ. Studies Div., Rept. to Ill. Inst. Environ. Qual., Dec. 1973. 296 pp. A survey of lands affected by surface mining and by coal refuse piles before the passage of legislation requiring reclamation is the basis for this comprehensive study. Water quality data show that the Kaskasia, Big Muddy, and Saline are the major Illinois rivers in which significant mine-related pollution occurs. Water treatment costs and reclamation costs are presented. There is also an analysis of tax revenue over a number of years from representative parcels of land. 73-38

D73-8 AMENDMENT TRIALS OF COAL SPOIL IN THE NORTH OF ENGLAND

Chadwick, M. J. (Univ. of York, U.K.), in "Ecology and Reclamation of Devastated Land," Vol. 2, R. J. Hutnik and G. Davis, Eds., New York: Gordon and Breach, 1973. Paper VI-4, pp 175-188. Various rates of limestone, several fertilizers, pulverized ash, and cationic bitumen emulsion were used with trees, grasses, and herbaceous legumes in six large-scale replicated trials on a variety of refuse types. Lime plus artificial fertilizer generally gave the best results. The several grasses and trees that were successfully grown on ammended refuse are noted. 631 H981

D73-9 OPERATION ANTHRACITE REFUSE

Charmbury, H. B. and Chubb, W. R. (Coal Res. Set., College Earth Miner. Sci.), The Pa. State Univ., Spec. Res. Rept. to U.S. Bur. Mines and Pa. Dept. Environ. Resour., SR-94 (1973). 37 pp.+ The purpose of this work was to find new uses for anthracite refuse. Three new uses developed with incinerated refuse were: anti-skid material for highways, substitute for aggregate in roadway blacktop, and as a soilless medium in greenhouses. Growth was obtained on incinerated refuse and silt basin refuse but was not too success-

D73-9 (continued)

ful on raw refuse banks. A separate section on transportation is included to show the cost of using material by distance it must be hauled from its source. 662.6 P4

D73-10 THE UTILIZATION OF INCINERATED ANTHRACITE MINE REFUSE AS AN AGGREGATE IN BITUMINOUS MIXES FOR SURFACING HIGHWAYS

Charmbury, H. B., Chubb, W. R., and Witkoski, F. C., The Pa. State Univ., Spec. Res. Rept. to Pa. Dept. Environ. Resour., SR-96 (1973). 27 pp. Conclusions from this study of the use of aggregate from burned-out refuse are that when properly crushed and sized it meets Department of Transportation specifications; that it has been used successfully in Luzerne County; and that skid resistance tests and visual inspections showed that the material held up as well in road tests as standard aggregate. 662.6 P4

D73-11 INVESTIGATION OF USE OF GEL MATERIAL FOR MINE SEALING

Chung, N. K. (Dravo Corp.), U.S. EPA, Office Res. & Monitoring, Environ. Protection Technol. Ser. EPA-R2-73-135 (1973). 67 pp. Neutralized mine refuse was one filler used in an acrylamide grout for remote sealing of mine voids. The project, carried out in a mine near Keystone Park in Western Pennsylvania, was to test a method of preventing acid mine drainage from an abandoned deep mine. 73-2

D73-12 COAL MINE HEALTH AND SAFETY INSPECTION MANUAL FOR COAL WASTE DEPOSITS

J. J. Davis Associates, Serendipity, Incorporated, and W. A. Wahler & Associates for Mining Enforcement and Safety Admin., U.S. Dept. Int., Contract No. S0133048, Sept. 1973. (114 pp.) The manual is intended to acquaint inspectors with the problems of coal waste disposal. It describes several refuse pile configurations and types of impoundments, and discusses the factors, especially water, that influence pile stability. Suggestions are given for making the inspection and recording observations. D331

D73-13 COAL MINE REFUSE AND FLY ASH TEAM UP AS BASE MATERIAL FOR HIGHWAY CONSTRUCTION

Coal Age 78 (13), 84 (1973). This news note describes the experimental parking lot and driveway installations at the U.S. EPA Crown, W. Va., Mine Drainage Field Site where coal refuse was used alone in an 18 inch base and as 75 percent of a mixture with fly ash in 12 and 15 inch bases. D283

D73-14 GOB PILE STABILIZATION, RECLAMATION, AND UTILIZATION

Coalgate, J. L., Akers, D. J., and Frum, R. W., W. Va. Univ., Coal Res. Bur., R&D Rept. No. 75, Interim Rept. No. 1 to U.S. Office Coal Res., Period of performance Feb. 1972-May 1973. 127 pp. All phases of coal refuse handling and disposal are reviewed. Environmental hazards discussed include the pre-

D73-14 (continued)

vention and control of refuse bank fires, refuse contribution to water pollution, and refuse bank instability. Methods of encouraging growth of vegetation on refuse, refuse pile construction, and refuse utilization are also discussed. D258

D73-15 RENKOL CLASSIFIER MAY BE MISSING LINK IN COAL PREPARATION

Collett, H., Coal Mining Process. 10 (6), 30-33, 60 (1973). The Renkol classifier separates marketable coal from coal refuse piles. Slurry in the unit goes counterclockwise unlike conventional hydrocyclones. Adjustments can be made while the plant is running at operating rate. D110

D73-16 ESTABLISHING FOREST ON SURFACE-MINED LAND AS RELATED TO FERTILITY AND FERTILIZATION

Czapowskyj, M. M., Forest Serv. Gen. Tech. Rept. NE-3, 1973. Reprinted from Forest Fertilization Symp. Proc., pp 132-139. Although the emphasis is on fertility of strip-mined spoil, information is included on plant growth on coal refuse. R532

D73-17 PERFORMANCE OF RED PINE AND JAPANESE LARCH PLANTED ON ANTHRACITE COAL-BREAKER REFUSE

Czapowskyj, M. M. (Northeastern Forest Expt. Sta., U.S. Dept. Agr.), in "Ecology and Reclamation of Devastated Land," Vol. 2, J. J. Hutnik and G. Davis, Eds., New York: Gordon and Breach, 1973. Paper VI-8, pp 237-245. All combinations of two levels of lime, two levels of fertilizer and four mulch treatments were used on a highly unfavorable site. The 4-year results show that lime application was essential for adequate survival and growth; pH values remained neutral in the top 4 inches of the limed plots; and neither mulch nor fertilizer treatments contributed substantially to tree establishment and growth. (From author's abstract) 631 H981

D73-18 LIME RETENTION IN ANTHRACITE COAL-BREAKER REFUSE

Czapowskyj, M. M. and Sowa, E. A. (Northeastern Forest Expt. Sta.), U.S. Forest Serv. Res. Note NE-154 (1973). 4 pp. Hydrated lime was applied to extremely acid anthracite coal-breaker refuse at rates of 2.5 and 5.0 tons per acre. The lime raised the pH to neutral range, and this range was still in evidence 7 years after treatment. The pH readings decreased with the depth of the refuse profile, and below 9 inches they approximated those of the control plots. The 2.5-tons-of-lime-per-acre treatment was almost as effective as the 5.0-ton treatment. Application of lime in establishing vegetation on coal-breaker refuse is recommended and encouraged. (Authors' abstract) CE49

D73-19 ENGINEERING CRITERIA FOR COAL WASTE DISPOSAL

D'Applonia, E., Amer. Mining Congr. Coal Conv., Pittsburgh, Pa., May 6-9, 1973. 10 pp. Also in Mining Congr. J. 59 (10), 42-46 (1973). Concern for

D73-19 (continued)

safety and environment requires criteria for the design and operation of areas for coal refuse. The main technical criteria relate to stability of embankment, ground water movement, and routing of storm floods. Critical also in application of these criteria are capital investment, maintenance and abandonment costs. Environmental consideration of leachates which are highly acidic, alkaline, toxic and exhibit other degrading characteristics relate directly to technical criteria for ground water flow and safety of coal refuse embankments. (Author's abstract). 662.6 A665

D73-20 RESEARCH ON RECLAMATION OF DEEP-MINE REFUSE PILES IN PENNSYLVANIA

Davidson, W. H., Forest Service, U.S. Dept. Agr., Final Rept. to Pa. Coal Res. Bd., 1973. 66 pp. Results of analyses of samples from more than 80 representative refuse piles in both anthracite and bituminous coal fields showed widely varying characteristics, but indicated that most refuse banks could support plant life, although most showed factors which could be adverse to plant establishment and development. Both greenhouse and field studies showed that soil amendments were needed to establish vegetation. Seedlings grown in six types of containers were compared with bare root seedlings. Containers did not improve survival on anthracite refuse, but two types of containers performed better on bituminous refuse. Recommendations for very acid spoil include addition of lime in advance of planting a seedling with follow-up applications if needed, and with refuse pH of 3.0 and below, covering it with soil suitable for plant establishment and growth. (From author's abstract) D165

D73-21 BUFFALO CREEK DAM DISASTER: WHY IT HAPPENED

Davies, W. E., Civil Engineering-ASCE 43 (7), 69-72 (1973). The coal waste banks and sludge ponds making up the Buffalo Creek dam site are described. The waste banks were used as dams because it had been found that water percolating through them was cleaned and complied with pollution control regulations. Investigation showed that the dam failed because there were no engineering plans or specifications for its construction. D317

D73-22 GEOLOGIC FACTORS IN WASTE BANK STABILITY

Davies, W. E. (U.S. Geol. Surv.), Mining Congr. J. 59 (1), 43-46 (1973). Refuse materials and topographical factors which add to waste bank instability are characterized. Some piles are high in bone coal, some in rock or clay and shale. Shale breaks down and is a very weak material when used as a foundation. Refuse should not be piled on washery sludge. Low bulk density material or light compaction gives weak stability. Void space in refuse piles is usually high and contributes to instability. Sandstone usually gives little trouble. This author believes special engineering is needed to get adequate stability in waste piles. D184

D73-23 SUMMARY OF DEMONSTRATION METHODS FOR EXTINGUISHING CULM-BANK FIRES

Flegal, R. C. and Gahr, N. J., U.S. EPA, Research Triangle Park, N. C., Inhouse Rept. No. APTD-1518, July 1973. 46 pp. NTIS, PB-222 836. Sealing, grouting, and mechanical-hydraulic methods of extinguishing burning coal-refuse banks were evaluated through 15 demonstration grants in three Appalachian states. Mechanical-hydraulic methods were most successful in terms of effectiveness and economy. However these methods require large quantities of water and a large disposal area, neither of which may be available at the burning waste-bank site. The wide diversity of coal-refuse-bank-sizes, shapes, compositions and locations makes selection of a universally recommended control method impossible. (From authors' abstract) D335

D73-24 ABNORMALITIES IN THE ROOTS OF TREES GROWING ON TOXIC DUMP MATERIAL

Harabin, Z. and Greszta, J. (Polish Academy of Sci.), in "Ecology and Reclamation of Devastated Land," Vol. 1, R. J. Hutnick and G. Davis, Eds., New York: Gordon and Breach, 1973. Paper IV-2, pp 413-428. A coal waste dump was one of the industrial dumps investigated. In toxic soils all tree species formed flat root systems with virtually all root development in and near surface layers. Anatomical changes seen could have been caused by this or directly by the toxicity of the dumps. 631 H981

D73-25 UNUSUAL DEPOSIT YIELDS QUALITY LIGHTWEIGHT AGGREGATE

Jeffers, P. E., Brick & Clay Record, Feb. 1973. pp 20-22. Coal is reclaimed from anthracite refuse and the residue crushed and expanded to make "Lelite." The Bylite Corp. of Wilkes-Barre produces up to 450 tons per day of the aggregate which has been used in the construction of large buildings in eastern cities. D321

D73-26 INVESTIGATIONS OF SOILS AND TREE GROWTH ON FIVE DEEP-MINE REFUSE PILES IN THE HARD-COAL REGION OF THE RUHR

Knabe, W. (Northrhine-Westphalian Inst. for Air Pollution Control and Land Use Protection), in "Ecology and Reclamation of Devastated Land," Vol. 1, R. J. Hutnik and G. Davis, Eds., New York: Gordon and Breach, 1973. Paper III-4, pp 307-324. The investigations showed that both burned and unburned refuse piles in the Ruhr can be successfully forested. Existing stands of hardwood have been able to reproduce themselves and promote soil development. Species recommended for planting are noted. 631 H981

D73-27 CONTROL OF MINE DRAINAGE FROM COAL MINE MINERAL WASTES: PHASE II - POLLUTION ABATEMENT AND MONITORING

Kosowski, Z. V., U.S. EPA, Office Res. Monitoring, Environ. Protection Technol. Ser. EPA-R2-73-230 (May 1973). 83 pp. This final report gives the results of an extensive project on mine drainage control and reclamation done at the New Kathleen Mine Site, and the coal cleaning operation of the

D73-27 (continued)

Union Collieries Company. The site had a 40-acre refuse pile and six slurry lagoons. Soil covers of 1 foot, 2 feet, and 3 feet thicknesses were tested. The results showed that a one-foot cover controlled acid production as well as a 3-foot cover. A number of vegetative covers were tested using standard agricultural techniques. Maintenance on the pile the first year showed that it is important to reseed and recover bare spots, otherwise the acid production will increase. Extensive detail is included on measuring acid flow rates. Conclusions on fertilizers, seed mixtures, and lime requirements indicated that because of wide variations in soil conditions, no specific guidelines can be recommended. Acid control was effective - before treatment the rate was 198 lbs/acre/day and after treatment it was 16 lbs/acre/day. D123

D73-28 PENNSYLVANIA REGULATIONS FOR COAL REFUSE DISPOSAL

Lazarchik, D. A. (Pa. Bureau Land Protection), Amer. Mining Congr. Coal Conv., Pittsburgh, Pa., May 6-9, 1973. 14 pp. The author discusses background of refuse handling and disposal procedure and reviews the development of rules and regulations, issued as a proposed document in August, 1972. Following a November hearing in 1972 a draft of the regulations was published on December 23, 1972. The steps required for a permit are outlined together with the respective fees. Application details are discussed and site maintenance procedures are explained. Generally, the state's attempt to regulate coal refuse piles is concerned with air pollution, water pollution, safety and appearance. 662.6 A665

D73-29 WASTE COAL RECLAMATION

Leonard, J. W. and Lawrence, W. F., W. Va. Univ., Coal Res. Bur., Rept. No. 92 (undated). 8 pp. Also in ACS Div. Fuel Chem. Preprints 18 (2), 232-238 (1973). The authors summarize the coal waste problem by discussing conditions in eleven representative years from 1917 through 1972. The size and composition of some coal waste banks in the Monongahela River drainage basin are tabulated. D316

D73-30 THE EFFECT OF SUSPENDED COAL PARTICLES ON THE LIFE FORMS OF THE AQUATIC MOSS *EURHYNCHIUM RIPARIOIDES* (HEDW.) I. THE GAMETOPHYTE PLANT; II. THE EFFECT ON SPORE GERMINATION AND REGENERATION OF APICAL TIPS

Lewis, K. (University College, Cardiff, U.K.), Freshwat. Biol. 3, 251-257, 391-395 (1973). The aquatic moss which is the subject of this study is commonly found throughout Great Britain, even, a survey showed, in discharges of coal washery water. Part I describes the laboratory study of the effects on the moss of suspensions of 100, 500, 1000, 2000, and 5000 mg/L of coal related solids. The suspended solid particles caused abrasion of the plants. Above 500 mg/L concentration, the suspended solids reduced growth significantly, probably as the result of abrasion but also possibly because of reduced availability of light. Part II describes a second laboratory study, using the same concentrations of suspended coal solids,

D73-30 (continued)

which was carried out with spores from mature capsules of the moss. Germination of the spores did occur with all suspensions, but was greatly decreased with the greatest concentration of solids. Part II also reports a laboratory study on apical tips of the plant material, freshly prepared without side shoots. After twenty days, lateral shoots had grown on plant material in controls and in low concentrations of solids, but none were produced in suspensions of 1000 mg/L or more. CE158

D73-31 CONSTRUCTING NON-POLLUTING COAL MINE WASTE DISPOSAL SYSTEMS

Lounsbury, R. W., Mining Eng. 25 (6), 48-51 (1973). The design and planning for the refuse disposal system operated by Monterey Coal Co. at its No. 1 Mine in Brushy Mound Township, Illinois are described. The system includes provision for constructing and maintaining slurry ponds and refuse embankments. The operating experience for more than two years is reviewed. Jour

D73-32 HAWLEY SUCCESSFUL IN ADAPTING SYSTEM TO RECOVER ULTRA-FINES

Mason, R. H., Coal Mining Process. 10 (5), 35-39, 55 (1973). A processing plant was developed in West Virginia to reclaim the fine coal from settling ponds when they became filled and additional space was not available. The method was adapted from one used by equipment to process chemicals and prepare foods and is effective with maximum moisture content of 22 percent. The system uses heated air during conveying and a special chopper to break up caked material. The fluid drying and conveying system will handle 21 tph and reduce the moisture content by 10 points. Ash content is also reduced from 20 percent to 12 percent. The dryer exhaust emissions have been maintained below the state code requirements. D114

D73-33 METHODS AND COSTS OF COAL REFUSE DISPOSAL AND RECLAMATION

U.S. Bur. Mines, IC 8576 (1973). 36 pp. NTIS N75-77143/6WP. Coal refuse disposal and reclamation methods and costs are presented for one coal company in Kansas, three in Kentucky, one in Ohio, two in Pennsylvania, and two in West Virginia. Six reclamation projects sponsored by the Commonwealth of Pennsylvania are also included. (From introduction) D77

D73-34 NEW USES FOR FLY ASH AND MINE WASTE: FLY ASH, COAL WASTE MADE INTO AGGREGATE; EPA UTILIZES MINE REFUSE-FLY ASH BASE COURSE IN ROAD CONSTRUCTION TEST AT CROWN CENTER

Green Lands 3 (3), 20 (1973). These are two news items. The first reports on a new patented aggregate called "LAPIDEX," developed in Hungary. The second summarizes EPA's use of the two waste products in paving projects at their Crown, W. Va. facility. D251

D73-35 ENVIRONMENTAL, LAYOUT AND PROCESS INNOVATIONS IN THE BULLITT PLANT

O'Brien, E. J. and Walker, J. L., Jr. (Dravo Corp.), Mining Congr. J. 59 (5), 36-42 (1973). The refuse handling system of the coal preparation plant at the Bullitt mine of Westmoreland Coal Co. is designed to return impounded water to the plant and to produce a solid cake dry enough to handle mechanically. There is one slurry pond to be used only in emergency. D109

D73-36 EMERGENCY INVESTIGATION OF COAL WASTE EMBANKMENTS

Osborn, E. E. (U.S. Bur. Mines), Mining Congr. J. 59 (1), 40-42 (1973). A special Task Force of the Dept. of the Interior has worked to make an inventory of coal refuse banks and impoundments and conducted emergency investigations of a number of the sites. The program and its findings are reviewed. D183

D73-37 DEEP-MINE WASTE RECLAMATION EXPERIMENTATION IN THE BITUMINOUS REGIONS OF PENNSYLVANIA

Schimp, P. E. (Bethlehem Mines Corp.), in "Ecology and Reclamation of Devastated Lands," Vol. 2, R. J. Hutnik and G. Davis, Eds., New York: Gordon and Breach, 1973. Paper VII-8, pp 457-467. Factors studied were germinative ability of seeds of trees, perennial grasses and annuals; effects of planting procedures and fertilizing methods on survival and growth of tree and shrub seedlings; and effects of refuse bank conditions on vegetation. High soil temperature from absorption of solar radiation and low soil moisture were found to have the greatest effect on plant survival. 631 H981

D73-38 SEALING OF COAL REFUSE PILES

Scott, R. B., U.S. EPA, Natl. Environ. Res. Center, Advanced Waste Treatment Lab., Crown, W. Va., Program Element 1B2040, July 1973. 15 pp. Seven 14' x 14' x 12" deep containers were constructed for the coal refuse so that water percolating through the pile could be measured. There was a control pile and six test piles: one with plastic covering; two treated for carbonate bonding; one covered with clay-type soil; one treated with sodium silicate; and one with sodium silicate and sodium aluminate. Water going through each pile was measured after major storms or after a period with at least 2" precipitation and tested for conductance, pH, acidity, alkalinity, calcium, magnesium, aluminum, sulfate, and total iron. The results show that the plastic cover was the most successful sealant although it required constant attention to keep it in place. Sodium silicate treatment was the second most successful treatment but seemed to be losing its effectiveness at the end of the almost year-long test period. Carbonate bonded layers at first were successful but broke up under weathering. It was suggested that lack of moisture during treatment and too little compaction because of hand tamping contributed to failure. 73-17

D73-39 BULK TRANSPORT OF ANTHRACITE REFUSE

Semon, E. A. and Schenck, G. H. K., Penn. State Univ., Spec. Res. Rept. to Pa. Dept. Environ. Resour., SR-93 (Jan. 30, 1973). 194 pp. Railroad, truck and pipeline rates, availability, convenience, and dependability are compared. One section of the report considers the recovery of anthracite fines from culm banks for use as power plant fuel. 662.6 P4

D73-40 PRINCIPLES OF DAM CONSTRUCTION

Starnes, W. L., Mining Congr. J. 59 (1), 47-50 (1973). Key factors in dam construction include suitable soils, competent design engineering, impervious core, proper compaction, inert material and regular inspections. Reference is made to coal refuse dams and a number of reasons for their failure. An earthen core is considered a necessary part of a refuse dam. Dams whose slopes are equal to the angle of repose of the refuse are too high and are undoubtedly unsafe. Proper compaction of refuse material is essential. D185

D73-41 COAL MINING REFUSE DISPOSAL - TODAY AND TOMORROW

Taylor, A. R., Colliery Guardian Annual Review, Sept. 1973. pp 91-96. British experience in dealing with coal refuse, and the National Coal Board rules and regulations covering refuse disposal are reviewed. D320

D73-42 COMPOSITIONAL AND GEOTECHNICAL CHARACTERISTICS OF A 100-YEAR-OLD COLLIERY SPOIL HEAP

Taylor, R. K. (Univ. Durham), Inst. Mining Met., Trans., Sect. A 82, A1-A14, Discussion of the paper, A145-A147 (1973). Samples were taken at a number of locations throughout the partially burnt, very coaly heap. Also determined as far as possible were the coal measures from which the refuse had come. Chemical-mineralogical correlation indicated that combustion in the heap had greatly changed its mineral constituents. D325

D73-43 McGREGOR PLANT GETS NEW COMBINATION CIRCUIT

Walls, D., Coal Mining Process. 10 (7), 50-53 (1973). The 400-tph combination hydrocyclone-heavy media coal cleaning circuit developed by Amherst Coal Company is described. Flow sheets and analyses of separation fractions are included. R86

D73-44 THE DISPOSAL OF COAL WASHERY REJECTS IN AUSTRALIA

Waters, P. L. (CSIRO Div. Miner. Chem.), PACE 26 (9), 17-19 (1973). In test studies, fluidized bed combustion of coal cleaning refuse gives a light-colored, inert, granular product suitable as a road fill, building material, or soil conditioner. The resulting fly ash has useful pozzolanic properties for cement and concrete products. D355

D73-45 FLOCCULATION OF COAL SLIMES

Werneke, M. F. (to American Cyanamid Co.), U.S. Pat. 3,717,574

D73-45 (continued)

(Feb. 20, 1973). 3 pp. Colloidal coal particles in aqueous alkaline medium are flocculated by the combined action of a low molecular weight water-soluble anionic polymer at least 50 mol percent composed of acrylic acid linkages and a high molecular weight anionic polymer at least 95 mol percent composed of acrylamide linkages, and adjusting the pH of the aqueous medium to a value below 7. A water-soluble anionic starch may be added as supplementary flocculent. (Abstract of the disclosure) D334

1974

D74-1 GOB PILE STABILIZATION AND RECLAMATION

Akers, D. J., Jr. and Muter, R. B., Proc. Fourth Miner. Waste Utilization Symp., Chicago, Ill., by U.S. Bur. Mines and IIT Res. Inst., 1974. pp 229-239. Also published with J. L. Coalgate as W. Va. Univ., Coal Res. Bur., Tech. Rept. No. 96 (1974). 21 pp. Gob pile fires and their control and prevention; water pollution and physical instability, including surface and subsurface slips, creep, liquefaction, and erosion; and revegetation and site preparation are discussed in this comprehensive paper. 622 M6, D372

D74-2 ANALYSIS OF POLLUTION CONTROL COSTS

Michael Baker, Jr., Inc., Rept. to Appalachian Regional Comm., Feb. 1973. 436 pp. Also published as Doyle, F. J., Bhatt, G., and Rapp, J. R., Michael Baker, Jr., Inc., Rept. to EPA, 670/2-74-009 (1974). NTIS, PB-233 026/4WP. The purpose of the publication is to provide data which will enable the Commission to estimate costs of pollution abatement in the Monongahela River Basin. Pollution both from coal mining and from non-coal sources is considered. Abatement methods discussed include mine sealing, stream diversion, and mine drainage treatment. 73-8, 74-11

D74-3 THE TECHNICAL AND ECONOMIC FEASIBILITY OF UNDERGROUND DISPOSAL SYSTEMS

Atwood, G. (Geologist), Natl. Coal Assoc./Bitum. Coal Res., Inc., First Symp. Mine and Prep. Plant Refuse Disposal Preprints, Louisville, Ky. (1974). pp 147-160. European practices in pneumatic and hydraulic stowing of refuse in mined-out areas are reviewed. The costs of the methods are compared to the costs of surface disposal. Under conditions current when the paper was prepared, underground disposal was more expensive than surface disposal. D456

D74-4 CHARACTERIZATION OF COAL REFUSE BY LOW TEMPERATURE ASHING

Augenstein, D. A. and Sun, S. C., Trans. AIME 256, 161-166 (1974). The apparatus and procedure are described. The mineral matter and the chemical constituents of the ash of 7 anthracite coals are tabulated. AIME

D74-5 ECOLOGY OF IRON-OXIDIZING BACTERIA IN PYRITIC MATERIALS ASSOCIATED WITH COAL

Belly, R. T. and Brock, T. D. (Univ. Wis., Dept. Bacteriology), J. Bacteriol. 117 (2), 726-732 (1974). This work describes a method for measuring $^{14}CO_2$ uptake by chemolithotrophic bacteria directly in pyrite materials associated with coal and coal refuse. Maximal $^{14}CO_2$ uptake occurred in coal refuse material 2-3 years old, and only slight incorporation was demonstrated in fresh material or material 40 years old. Surface samples demonstrated maximal $^{14}CO_2$ uptake as comapred to samples below 8-10 cm with only slight activity. Optimum uptake activity occurred at 20-30°C, and a moisture content of 23-35%. Heterotrophic fungi and yeasts were routinely isolated in high numbers from acidic coal refuse. There was good correlation between $^{14}CO_2$ uptake and the most probable number of iron-oxidizing bacteria. (From authors' abstract) 74-4

D74-6 A REFUSE BANK RECLAMATION PROJECT

Blakely, J. W., Coal Mining Process. 11 (2), 30-31 (1974). A 30 acre refuse bank at the Winifrede Division of Carbon Fuel Co., Kanawha County, W. Va. has been graded, covered with clay and topsoil, seeded, and planted with 300 apple trees. Current refuse continues to be deposited in the area in such a way that reclamation can continue. Natural drainage has been channeled away from the refuse bank. Preparation plant water goes to a settling basin at the toe of the refuse pile and empties into an abandoned mine from which in turn the water is obtained for the preparation plant. D315

D74-7 DEPTH OF SOIL COVERING REFUSE (GOB) VS. QUALITY OF VEGETATION

Brundage, R. S. (Peabody Coal Co.), Natl. Coal Assoc./Bitum. Coal Res., Inc., First Symp. Mine and Prep. Plant Refuse Disposal Preprints, Louisville, Ky. (1974). pp 183-185. Evaluation of vegetation that had been growing on soil-covered refuse areas for up to eleven years showed no difference in growth on coverings of 1, 2, 3 or 4 feet. Areas with less than 8 inches of soil cover had obviously less vegetative cover. Recommendations for covering abandoned piles include proper grading; covering with 12 to 18 inches of soil capable of supporting vegetation; and planning vegetation to reduce erosion and to prepare the site for future use. D460

D74-8 PHYSICAL PROPERTY DATA ON COAL WASTE EMBANKMENT MATERIALS

Busch, R. A., Backer, R. R., and Atkins, L. A., U.S. Bur. Mines, RI 7964 (1974). 142 pp. Eight coal waste banks in West Virginia were chosen for study. In situ density tests were carried out. Sampling was carried out for laboratory characterization of material including permeability, grain size gradation, specific gravity, shear strength and compression. Among the recommendations are that local information on specific gravity and density should be obtained since these values for the samples studied varied considerably; and that work should be done in the field on pile density control to improve stability. D368

D74-9 UTILIZATION OF COAL MINE REFUSE IN THE CONSTRUCTION OF HIGHWAY EMBANKMENTS

Butler, P. E. (Pa. Dept. Transportation), Natl. Coal Assoc./Bitum. Coal Res., Inc., First Symp. Mine and Prep. Plant Refuse Disposal Preprints, Louisville, Ky. (1974). pp 237-255. Studies on grain-size distribution and moisture density relationship showed that refuse could be compacted to keep air out and prevent combustion. This was confirmed by monitoring with thermocouples an embankment built from refuse on the Cross Valley Expressway in Luzerne County, Pa. Other projects planned for use of refuse are listed. D465

D74-10 FLY ASH FROM COAL BURNING POWERPLANTS: AN AID IN REVEGETATING COAL MINE REFUSE AND SPOIL BANKS

Capp, J. P. and Gillmore, D. W. (U.S. Bur. Mines, Morgantown, W. Va.), Natl. Coal Assoc./Bitum. Coal Res., Inc., First Symp. Mine and Prep. Plant Refuse Disposal Preprints, Louisville, Ky. (1974). pp 200-211. Although the emphasis in this paper is on fly ash amendments to surface mine spoil and agricultural land, almost 60 acres of refuse disposal areas are noted as having benefited by fly ash addition. D462

D74-11 SOIL-MAKING POTENTIAL OF POWERPLANT FLY ASH IN MINED-LAND RECLAMATION

Capp, J. P. and Gillmore, D. W., (U.S. Bur. Mines, MERC), in "Ash Utilization," Proc. Third International Ash Utilization Symp., Pittsburgh, Pa., 1973, U.S. Bur. Mines IC 8640 (1974). pp 258-268. The use of fly ash in restoring surface mine spoils and coal waste dumps is related to its alkaline character and ability to neutralize acid materials, the addition of mineral nutrients, its positive effect on moisture holding capacity, and decrease in soil and refuse material bulk density. Plants growing well on fly ash treated materials are listed. Costs of using fly ash are also estimated. BurM

D74-12 COAL AND THE ENVIRONMENT

Charmbury, H. B., Coal Mining Process. 11 (1), 69-70 (1974). The author points out ways to handle refuse and water during the mining operation and gives guidelines for building refuse piles. Jour

D74-13 CLEANING UP COAL WASTES

Ecos, CSIRO Environmental Res. No. 1, Aug. 1974. pp 11-14. The problems of coal refuse disposal and the studies carried out in Australia to use refuse as a low-grade fuel in fluidized-bed combustion are reviewed. CE48

D74-14 COAL REFUSE PILES SEEN AS VALUABLE GAS SUPPLY

Earthmoving and Construction, p 24, Summer 1974. Dr. Philip Walker of Penn State explains in this news note that coal refuse can be used in commercial

D74-14 (continued)

gasifiers to produce low Btu gas for process heat. Present research at Penn State concerns determination of coals suitable for different gasifiers. D356

D74-15 COLLIERY SPOIL

Precast Concrete 5 (7), 393-396 (1974). The uses of coal refuse (colliery spoils) in Britain are described. Chemical analyses of burnt and unburnt spoils are tabulated. Also tabulated are quantities of spoil in NCB ownership in 1966, by area. D380

D74-16 A NEW CONCEPT IN STABILITY ANALYSIS OF SEEPED MINE-REFUSE EMBANKMENTS

Corp, E. L. and Schuster, R. L. (U.S. Bur. Mines, Spokane Mining Res. Cent.), Natl. Coal Assoc./Bitum. Coal Res., Inc., First Symp. Mine and Prep. Plant Refuse Disposal Preprints, Louisville, Ky. (1974). pp 91-114. A new analysis concept using finite-element methods has been developed to combine the effects of seepage directly into computations for slope stability of dams or embankments. Seepage forces, superimposed on gravity loads, are used in an elastic-plastic program to compute slope factors of safety. Computer output provides a cross-sectional plot of the dam or embankment showing the safety factors for each element. The method was first tested using trial embankments, and the results compared with those obtained from conventional analysis. Both methods predict failure, but the finite-element analysis shows a different mode of failure and development of potential failure zones not indicated by conventional methods. To test the validity of the concept, both new and conventional analyses were compared for the 1972 Buffalo Creek Dam failure. Findings of the finite-element model corroborate those of conventional methods, and in addition show an alternative mode of failure. (From authors' abstract) D452

D74-17 PNEUMATIC STOWING: IT MUST BE LOOKED AT NOW

Courtney, W. J. and Singh, M. M., Coal Mining Process. 11 (2), 27-29, 43-44 (1974). Machinery used in pneumatic stowing is described and costs at several European mines are compared. The lateral method of stowing has been developed to keep up with the rapidly advancing longwall face. D314

D74-18 THE ONEIDA PLANT

Daub, C. H., Mining Congr. J. 60 (7), 20-27 (1974). The new coal preparation facility at the Conemaugh No. 4 Mine of the North American Coal Corp. Subsidiary, Oneida Mining Company, is described. Refuse disposal is in an area designed to carry runoff into the mine where it will be added to the mine water to be treated. Two slurry disposal ponds are also planned. Clear water will be returned from the ponds to the preparation plant. D352

D74-19 RECLAIMING REFUSE BANKS FROM UNDERGROUND BITUMINOUS MINES IN PENNSYLVANIA

Davidson, W. H. (Northeastern Forest Expt. Sta., U.S. Dept. Agri.), Natl. Coal Assoc./Bitum. Coal Res. Inc., First Symp. Mine and Prep. Plant Refuse Disposal Preprints, Louisville, Ky. (1974). pp 186-199. Chemical and physical analyses of samples from 79 sites showed a wide variation in results but indicated generally that although chemical parameters were unfavorable to plant growth, physical characteristics were not. Greenhouse and field studies showed that lime and fertilizer were needed to establish grasses on refuse banks. Field studies showed further that a mulch was also needed. Tree (red pine) survival did not seem to be influenced by soil amendments. The results of a field study on the effects of furrowing were inconclusive. D461

D74-20 CURRENT STATUS OF PROPOSED FEDERAL WASTE DISPOSAL RULES

Day, J. M., Mining Congr. J. 60 (6), 53-56 (1974); American Mining Congress Coal Convention, Pittsburgh, Pa., May 5-8, 1974. 9 pp. The activities of the Mining Enforcement and Safety Administration included the development of Hazard and Emergency Hazard Rating Systems and The Coal Mine Health and Safety Inspection Manual for Coal Mine Waste Deposits, and work on evaluating stability of coal waste deposits. D346

D74-21 VARIABLES AFFECTING GRADING COSTS FOR STRIP MINE AND REFUSE BANK RECLAMATION

Doyle, F. J. (Michael Baker, Jr., Inc.), Natl. Coal Assoc./Bitum. Coal Res. Inc., First Symp. Mine and Prep. Plant Refuse Disposal Preprints, Louisville, Ky. (1974). pp 212-227. Of the many site characteristics identified and tabulated, the volume of refuse to be moved is considered as being the main cause of differences in grading costs from one project to another. D463

D74-22 SYNOPSIS OF ENGINEERING AND DESIGN MANUAL FOR COAL REFUSE EMBANKMENTS

Ellison, R. D. and Almes, R. G. (E. D'Appolonia Consulting Engineers, Inc.) Natl. Coal Assoc./Bitum. Coal Res., Inc., First Symp. Mine and Prep. Plant Refuse Disposal Preprints, Louisville, Ky. (1974). pp 115-127. The purposes of this paper are to describe briefly the content of the Manual prepared for the Mining Enforcement and Safety Administration, and to illustrate its utility to regulatory agencies, coal operators, and consultants retained to assist in the design and implementation of safe coal refuse disposal practices. D453

D74-23 EUROPEAN PRACTICE IN UNDERGROUND STOWING OF WASTE FROM ACTIVE COAL MINES

Fairhurst, C. (Univ. Minn.), Natl. Coal Assoc./Bitum. Coal Res., Inc., First Symp. Mine and Prep. Plant Refuse Disposal Preprints, Louisville, Ky. (1974). pp 145-156. This abstract of the Symposium presentation emphasizes the fact that disposal of refuse in underground mines in Europe

D74-23 (continued)

was developed in response to a need for refuse disposal and to aid in solving problems of mining including surface subsidence, ground disturbance with multiple-seam mining, and "bumps" or violent collapse of mine workings because of pressure buildup. D455

D74-24 OVERVIEW OF UNDERGROUND REFUSE DISPOSAL

Falkie, T. V., Gilley, J. E., and Allen, A. S. (U.S. Bur. of Mines), Natl. Coal Assoc./Bitum. Coal Res., Inc., First Symp. Mine and Prep. Plant Refuse Disposal Preprints, Louisville, Ky. (1974). pp 128-144. The paper reviews the status of coal refuse and various methods of using or disposing of the waste material. The authors conclude that, "Stable surface disposal systems can be designed with pre-planning, site selection, and reclamation to return the surface area to use following mining. Utilization of refuse will occur on a local basis only, without much potential for large scale use other than as land- or construction-fill or as backfill material in subsidence control projects. Underground disposal of coal waste in abandoned mines is feasible and has been used. Two goals are achieved-subsidence control and surface improvement. Disposal in active mines appears feasible in certain instances, however, problems in mining economics, mine worker safety, and environmental problems remain to be solved before the practice can be adopted as a part of the production cycle." D454

D74-25 THE USE OF UNBURNT COLLIERY SHALE IN ROAD CONSTRUCTION

Fraser, C. K., U.K. Dept. Environ., Transport and Road Res. Lab., Scottish Branch, Suppl. Rept. 20 UC (1974). 7 pp.+ Summaries and Road Res. Lab., used unburnt colliery shale for road embankments and fill are contained in this report. There seem to have been no instances of combustion even in areas where the recommended inert cladding had been omitted. It is noted that no special restrictions beyond general engineering requirements were needed for shale use; and that ease of handling shale in wet weather is the most significant advantage of its use. CE230

D74-26 PLANTING TREES ON WASTE LAND

Gemmell, R. P., Surveyor 144 (4288), 30-32 (1974). The author describes the planting techniques needed for raw wastes including colliery spoil. Limestone must be applied by deep cultivation in order to significantly raise the pH. This promotes deep rooting which improves survival. A fertilizing project is described showing the clear need for nitrogen and phosphate in addition to limestone. Dried sewage sludge proved to be a good soil amendment. Pre-planting of grasses can improve tree growth and survival. D375

D74-27 STATE OF THE ART OF SUBSIDENCE CONTROL

Gray, R. E., Gamble, J. C., McLaren, R. J., and Rogers, D. J., General Analytics, Inc., Final Rept. to Appalachian Regional Comm. and Pa. Dept. Environ. Resour., ARC--73-111-2550 (1974). 273 pp. NTIS, PB-242 465/AS.

D74-27 (continued)

For abandoned mines, selective support methods, such as grout columns, deep foundations and piers; and filling methods, such as hydraulic flushing, pneumatic filling, fly ash injection, grouting, blasting and over-excavation are described and approximate costs presented. Techniques to evaluate subsidence potential are included. For active mines, principles of subsidence development above tabular deposits are discussed, including a review of research studies and predictive methods. Subsidence control, by cancelling or selectively positioning surface strains, and subsidence prevention by subsurface support are described with examples. There are 192 annotated references. (From authors' abstract) D420

D74-28 FILTRATION OF COAL REFUSE

Hegyan, D. T. and Zugates, T. B., AIME Ann. Meet., Dallas, Tex., Feb. 23-28, 1974. Preprint No. 74-F-23. 19 pp. Also in Trans. AIME 260, 77-80 (1976). This paper discusses the authors' past experience filtering refuse, effects of solids concentration in the filter feed, use of polymer flocculation aids, effect of flocculation devices, and effects of particle size and ash content on the filtration rate. Detailed tests were performed on existing installations utilizing coal refuse filters to determine optimum flocculant dosage, solids concentration, and disc rotation speed to form a dischargeable cake. It was also confirmed that controlled additions of polymer flocculants will reduce filter refuse cake moisture somewhat. (Adapted from authors' Summary) D342, D423

D74-29 UNDERGROUND STORAGE OF COAL MINE WASTE

Kaufman, P. J. and McCuskey, J., Proc. Fourth Miner. Waste Utilization Symp., Chicago, Ill., by U.S. Bur. Mines and IIT Res. Inst., 1974. pp 275-283. These authors, both lawyers, discuss underground storing as a practical means of solving many waste problems. Pneumatic and hydraulic methods are discussed in detail in addition to integration of underground coal waste with retreat mining methods and longwall methods. Abandoned mines are seen as good locations for disposal. Benefits and problems of underground storage included a rather significant cost but the overall results appeared to make this method very attractive. 622 M6

D74-30 REMOTE SENSING TECHNIQUES FOR ANALYSIS OF BURNING IN COAL REFUSE BANKS

Knuth, W. M., Jr. (1) and Charmbury, H. B. (2) [(1) HRB-Singer, Inc. and (2) Mining Consultant], Natl. Coal Assoc./Bitum. Coal Res., Inc., First Symp. Mine and Prep. Plant Refuse Disposal Preprints, Louisville, Ky. (1974). pp 38-43. The technique uses a scan during aircraft flights to produce records on digital magnetic tapes which are analyzed through specially designed computer programs. The analyses permit inventory of burning refuse banks and monitoring the success of projects to extinguish refuse bank fires. D447

D74-31 EFFECT OF MULCHES AND AMENDMENTS ON THE SURVIVAL AND GROWTH OF VEGETATION PLANTED ON ANTHRACITE PROCESSING WASTES

Kusko, M., Jr. and Hutnik, R. J. (School Forest Resour.), Pa. State Univ., Spec. Res. Rept., SR-101 (1974). 86 pp. Field experiments were conducted on two refuse sites in the Pennsylvania anthracite region: one, a large sludge dam which had been covered with large breaker refuse; and the other, a smaller sludge dam near a refuse bank. The purposes of the study were to determine the quantitative effect of various mulches on the moisture content and temperature of the refuse and the effect of various mulches and lime-fertilizer treatment on establishment and growth of trees, grasses and legumes. 662.6 P4

D74-32 STATE-OF-THE-ART IN EXTINGUISHING REFUSE PILE FIRES

Magnuson, M. O. and Baker, E. C. (U.S. Bur. Mines), Natl. Coal Assoc./Bitum. Coal Res., Inc., First Symp. Mine and Prep. Plant Refuse Disposal Preprints, Louisville, Ky. (1974). pp 165-182. In discussing the causes of refuse fires, it is pointed out that air circulation through the pile not only supplies oxygen but carries heat that can build up until ignition results. Methods of refuse pile construction to minimize air circulation and prevent fires are suggested. Extinguishing refuse fires by sealing the pile or by injecting fly ash slurry are described as is the most successful method, digging-out and cooling. D459

D74-33 COAL WASTE CAN BECOME AN ASSET

Maneval, D. R., Coal Mining Process. 11 (2), 34-37 (1974). The problem of coal refuse and European and United States efforts to use or reclaim it are reviewed. D313

D74-34 RECENT FOREIGN AND DOMESTIC EXPERIENCE IN COAL REFUSE UTILIZATION

Maneval, D. R. (Appalachian Reg. Comm.), Natl. Coal Assoc./Bitum. Coal Res., Inc., First Symp. Mine and Prep. Plant Refuse Disposal Preprints, Louisville, Ky. (1974). pp 256-262. The use of refuse in a variety of construction materials and as a landfill material is discussed. D466

D74-35 UTILIZATION OF COAL REFUSE FOR HIGHWAY BASE OR SUBBASE MATERIAL

Maneval, D. R. (Appalachian Regional Comm.), Proc. Fourth Miner. Waste Utilization Symp., Chicago, Ill., by U.S. Bur. Mines and IIT Res. Inst., 1974. pp 222-227. The British experiments with refuse and its utilization, especially as road building material, are reviewed. Pennsylvania's and West Virginia's refuse utilization programs are noted and suggestions are made for future refuse utilization in the U.S. 622 M6

D74-36 QUALITY OF EFFLUENTS FROM COAL REFUSE PILES

Martin, J. F. (U.S. EPA, Natl. Environ. Res. Cent., Cincinnati, Ohio), Natl. Coal Assoc./Bitum. Coal Res., Inc., First Symp. Mine and Prep. Plant

D74-36 (continued)

Refuse Disposal Preprints, Louisville, Ky. (1974). pp 26-37. Effluents from refuse piles in Pennsylvania, West Virginia, Kentucky, and Indiana were sampled in the spring of 1974 and results of water analyses are tabulated and compared with analyses from the literature including analyses of effluents in Illinois. Amounts of metal ions and acidity and alkalinity are related to the coal seams and their geochemical characteristics. Pollution is also related to refuse pile construction. Suspended sediment seems to be more of a pollution problem than acid or metals in an area covering southern West Virginia and eastern Kentucky. 74-51

D74-37 COAL BY-PRODUCTS CONSTITUTE HIGHWAY BASE

Mason, R. H., Coal Mining Process. 11 (5), 45, 63 (1974). In experimental parking lot and driveway installations at the U.S. EPA Crown, W. Va., Mine Drainage Field Site, coal refuse was used alone in an 18 inch base and as 75 percent of a mixture with fly ash in 12 and 15 inch bases. D340

D74-38 COAL MINE REFUSE: AN ENGINEERING MATERIAL

Moulton, L. K., Anderson, D. A., Seals, R. K., and Hussain, S. M. (W. Va. Univ., Dept. Civil Eng.), Natl. Coal Assoc./Bitum. Coal Res., Inc., First Symp. Mine and Prep. Plant Refuse Disposal Preprints, Louisville, Ky. (1974). pp 1-25. Laboratory studies were carried out to characterize refuse from four sites in West Virginia. Refuse from one of the areas was used experimentally as a base for parking lot pavement at the Crown Mine Drainage Control Field Site in West Virginia. Test results from that project are reported and show that refuse material may have potential for use as a construction material. D446

D74-39 MOUNTAINEER EXPERIMENT IS UNDER WAY

Green Lands 4 (3), 25 (Fall 1974). Consolidation Coal Co. and U.S. Soil Conservation Service cooperated on a project to control water pollution from a coal refuse dump near the Williams Mine at Enterprise, Harrison County, W. Va. An inactive slurry impoundment was filled with refuse, limestone and fertilizer were disced in, and grass seed applied. There was grass cover after one month. Jour

D74-40 CLOSED SYSTEM HYDRAULIC BACKFILLING OF UNDERGROUND VOIDS

Patterson, R. M. (The Dow Chemical Co., Dowell Div.), Natl. Coal Assoc./ Bitum. Coal Res., Inc., First Symp. Mine and Prep. Plant Refuse Disposal Preprints, Louisville, Ky. (1974). pp 161-163. This backfilling technique uses high velocity feed to fill mined-out areas. Projects to control subsidence in Rock Springs, Wyoming and Scranton, Pennsylvania are described. D457

D74-41 A FEDERAL VIEW OF THE COAL WASTE DISPOSAL PROBLEM

Peluso, R. G. (MESA), Mining Congr. J. 60 (1), 14-17 (1974). The Mining

D74-41 (continued)

Enforcement and Safety Administration's program for inspecting coal refuse banks and for developing guidelines for coal waste embankment design and construction is reviewed. The article also describes and illustrates some of the conditions found and corrections recommended in the evaluation of about 400 sites in five states. D299

D74-42 ENGINEERING ENVIRONMENTAL AND ECONOMIC PLANNING FOR COAL REFUSE DISPOSAL

Poellot, J. H. and Almes, R. G. (E. D'Appolonia Consulting Engineers, Inc.), Water Resour. Problems Related to Mining, Am. Water Resour. Assoc., Proc. No. 18, June 1974. pp 99-108. The discussion of the factors which must be considered in planning a mining and refuse disposal include mining and preparation methods, transportation of refuse, disposal area design and operation. A review of a study of site selection for a refuse disposal area at a new mine being developed in northern West Virginia is given as an example of the analysis that should be carried out. 628.2 H13

D74-43 PROBLEMS IN UNDERGROUND DISPOSAL IN ACTIVE MINES

Poundstone, W. N. (Consolidation Coal Co.), Natl. Coal Assoc./Bitum. Coal Res., Inc., First Symp. Mine and Prep. Plant Refuse Disposal, Louisville, Ky. (1974). 6 pp. The characteristics of United States underground mines and mining practices that make return of refuse to mined-out areas economically unfeasible are discussed. The author advocates disposing of coal refuse in layered and compacted piles which are covered with topsoil, vegetated and used as productive land. D458

D74-44 PHOTODEFORMATION MEASUREMENTS OF REFUSE PILE STRUCTURE MOVEMENTS

Powell, J. R., Reich, M., Steinberg, M., and Kopp, J. (Brookhaven Natl. Lab.), Natl. Coal Assoc./Bitum. Coal Res., Inc., First Symp. Mine and Prep. Plant Refuse Disposal Preprints, Louisville, Ky. (1974). pp 44-63. Computer scanning of film of marked mine interiors and adjacent structures such as refuse piles is described as a method that could be used to predict unsafe conditions. D448

D74-45 CLOSED CIRCUIT PREPARATION PLANTS AND SILT PONDS

Pritchard, D. T., Mining Congr. J. 60 (11), 30-33 (1974). Emphasis in the preparation practices at Pickands Mather Chisholm Mine in Kentucky and the Madison Mine in West Virginia is on the closed water circuit and the use of large silt ponds to remove particulates from the recirculated water. Several large ponds, at least equaling or exceeding thickener capacity, are necessary. The ponds are cleaned usually two or three times a year. D369

D74-46 RECONNAISSANCE SURVEY REPORT OF COAL-MINE REFUSE DUMPS AND IMPOUNDMENTS

W. A. Wahler and Associates, Rept. to MESA, Office Tech. Support, Feb. 1974. Vol. 1. State of Alabama, NTIS, PB-233 733. Vol. 2. State of Kentucky, PB-233 734. Vol. 3. State of Ohio, NTIS, PB-233 735. Vol. 4. State of Pennsylvania, NTIS, PB-233 736. Vol. 5. State of Virginia, NTIS, PB-233 737. Vol. 6. State of West Virginia, NTIS, PB-233 738. Each site report contains data on ownership, location, dimensions, history, geology, hydrology and coal seam mined, type of mining, preparation plant process and equipment, materials involved and rates of disposal. Both ground and aerial photogrpahs illustrate particular features of each site. Five sites were surveyed in Alabama, 30 in Kentucky, 4 in Ohio, 24 in Pennsylvania, 14 in Virginia, and 49 in West Virginia. D362-D367

D74-47 SELF-LOADING SCRAPER MOVES REFUSE EFFICIENTLY AND INEXPENSIVELY

Coal Age 79 (6), 78-79 (1974). The Itmann Mining Company's use of a Wabco 333 FT self-loading scraper to relocate a refuse dump while handling currently produced refuse is described. D345

D74-48 INNOVATIONS IN TAILINGS DISPOSAL

Shields, D. H. (Univ. Ottawa), Natl. Coal Assoc./Bitum. Coal Res., Inc., First Symp. Mine and Prep. Plant Refuse Disposal Preprints, Louisville, Ky. (1974). pp 86-90. Two designs used for refuse disposal at metal mines in Canada are described. In one system, waste material is discharged downvalley from a relatively low cross-valley dam. A low control structure at the downstream end of the system acts as a decant structure and controls the recycle water required by the plant. In the second system, there is a central discharge which results in much larger storage capacity because the central cone of material can build up higher than the low perimeter dam required to collect drainage. D451

D74-49 METHOD FOR TREATMENT OF COAL WASHERY WATERS

Shubert, R. H., U.S. Pat. 3,856,668 (Dec. 24, 1974). 7 pp. In this method, coal is agglomerated by agitation with heavy hydrocarbon oil and removed from the washery water. The mineral fraction settles out leaving a clarified water stream. CE58

D74-50 SOLIDIFYING COLLIERY TAILINGS

Colliery Guardian 222 (2), 62-63 (1974). The Chemfix process developed by Environmental Sciences, Inc. of Pittsburgh, Pa. is described. Industrial waste, including coal washery water can be treated to form a manageable solid material. Jour

D74-51 ESTABLISHING VEGETATION ON ACIDIC COAL REFUSE MATERIALS WITHOUT USE OF TOPSOIL COVER

Sorrell, S. T. (Consolidation Coal Co.), Natl. Coal Assoc./Bitum. Coal Res.,

D74-51 (continued)

Inc., First Symp. Mine and Prep. Plant Refuse Disposal Preprints, Louisville, Ky. (1974). pp 228-236. The project was carried out at a 12 acre, inactive coal-slurry impoundment at Mountaineer Coal Company's Williams Mine at Enterprise, West Virginia. The amount of limestone and fertilizer needed to establish a permanent grass cover were determined by analyses of 10 representative samples of refuse. A suitable mixture of seeds was sown after grading and preparing the site. Germination and plant growth generally resulted in dense vegetation, although in several places where inadequate grading allowed water to accumulate for several days, vegetation was not established. D464

D74-52 FLUIDIZED-BED COMBUSTION AS A SOLUTION TO THE ENVIRONMENTAL PROBLEMS OF COAL MINING WASTE

Szpindler, G. à D., Waters, P. L., and Young, C. C. (CSIRO, Div. Miner. Chem.), Process Industries in Australia - Impact and Growth, Natl. Chem. Eng. Conf. 1974, Queensland, Australia (July 10-12, 1974). pp 391-403. The paper discusses the environmental problems arising from the current practice of accumulating washery rejects in large dumps, and indicates how these problems could be reduced by burning rejects in fluidized-bed incinerators. The performance of a 50 kg/h test rig, designed for this purpose, using five different samples of rejects is described. The following points are discussed: the effects of air and fuel feed rates on bed temperature and how this may be controlled by direct and indirect water cooling; heat distribution under various conditions; entrainment of fly-ash; and properties of the burnt rejects and their potential uses. The purpose of this work was to determine optimum conditions and to gather design data for a large scale plant. (Authors' Summary) D433

D74-53 FLUIDIZED-BED COMBUSTION OF LOW GRADE FUELS

Szpindler, G. à D., Waters, P. L., and Young, C. C. (CSIRO Div. Miner. Chem.), Symp. Changing Technol. Electrostatic Precipitation, Inst. Fuel Conf. (Australian Membership), 1974. Paper 6. 15 pp. The effects of shale and water inerts on the calorific value of washery reject feed and on furnace temperatures theoretically attainable are discussed. The performance of an experimental fluidized-bed combustor burning washery reject with 67 percent ash is described, in particular the effects of the feed rates of air and fuel on bed temperature. Methods of controlling bed temperature by direct and indirect water cooling and by excess air are also described. CE47

D74-54 A SURVEY OF THE OUTPUT AND CHARACTERISTICS OF REJECT MATERIAL FROM COAL WASHERIES IN NEW SOUTH WALES

Szpindler, G. à D. and Waters, P. L., CSIRO Miner. Res. Lab., Div. Miner. Chem., Invest. Rept. 101 (April 1974). 6 pp.+ This survey, carried out in 1970-71, showed that 38 washery plants discarded about 5.8 million tons of both coarse and fine wastes. Information on both the quality and quantity of refuse produced was sought in investigating the suitability

D74-54 (continued)

of fluidized-bed combustion for treating refuse. Data obtained are tabulated in an appendix. D386

D74-55 TAILING DAM SPILL ALERT WARNING SYSTEM

World Mining 27 (3), 51 (1974). A method which predicts the collapse of tailings or coal refuse dams by measuring acoustic emissions was developed at Drexel Univ. The sub-audible sounds produced by soil under stress are measured. Measurements made in the field are compared with those made in laboratory tests and obtained from properly designed dams to assess the safety of dams under investigation. D357

D74-56 COLLIERY SPOIL HEAP MATERIALS - TIME DEPENDENT CHANGES

Taylor, R. K., Ground Eng. 7 (4), 24-27 (July 1974). Spoil (coal refuse) in heaps is affected by various conditions which cause changes in character and particle size. Disintegration of refuse is related to its mineralogy, sedimentary structures, and slaking. Chemical weathering of unburnt heaps takes place in top layers of the heaps. Refuse is changed most by burning, and the causes of burning spoil and the characteristics of burnt spoil are described. Burning can affect shear strength and the differences between the shear strength of unburnt, partly burnt, and burnt spoil are discussed. D381

D74-57 SULPHATE SPECIES IN COLLIERY SPOIL BANKS

Taylor, R. K. and Hardy, R. G. (Univ. Durham), Inst. Mining Met. Trans. Sect. A 83, A123-A126 (1974). Sulfate derived from pyrite oxidation can react with available cations to form various mineral species. Examples of sulfate minerals found in various tips throughout Great Britain are tabulated. D416

D74-58 MANUFACTURING CERAMIC GOODS OUT OF MINING WASTES

Toyabe, Y., Matsumoto, G., and Kishikawa, H., Proc. Fourth Miner. Waste Utilization Symp., Chicago, Ill., by U.S. Bur. Mines and IIT Res. Inst., 1974. pp 241-244. Coal mine washing debris was used with hard pottery stone containing FeS as an impurity to produce dense pottery materials of varying formulations for various products including heavy weight anti-abrasive floor tiles. 622 M6

D74-59 COAL REFUSE REGULATIONS, STANDARDS, CRITERIA, AND GUIDELINES

Wahler, W. A. (W. A. Wahler & Associates), Natl. Coal Assoc./Bitum. Coal Res., Inc., First Symp. Mine and Prep. Plant Refuse Disposal Preprints, Louisville, Ky. (1974). pp 78-85. The background to the development of coal refuse legislation and the regulations in force and being proposed are reviewed. The conditions for effective implementation of coal refuse legislation are discussed. D450

D74-60 COAL WASTES: WHAT CAN BE DONE

Wahler, W. A., Coal Mining Process. 11 (1), 71-74, 102, 104 (1974). This is a critical discussion of coal refuse disposal and methods used to prevent refuse embankment failures. It is pointed out that some methods meant to improve the stability of the refuse banks could actually contribute to failures, and that environmental and safety regulations administered by various government agencies overlap or are in conflict, compounding instead of alleviating the problem. Proposed federal and state regulations and existing state regulations are also discussed with emphasis on the difficulty of building safe embankments if regulations to be complied with are too specific and rigid. Criteria for obtaining the expertise of consultants are also set forth. Jour

D74-61 USE OF COAL MINE REFUSE AND FLY ASH AS A ROAD BASE MATERIAL

Wilmoth, R. C. and Scott, R. B. (U.S. EPA Crown Mine Drainage Control Field Site), Natl. Coal Assoc./Bitum. Coal Res., Inc., First Symp. Mine and Prep. Plant Refuse Disposal Preprints, Louisville, Ky. (1974). pp 263-275. The project at EPA's Crown Mine Drainage Control Field Site in West Virginia is described. D467

D74-62 SURVEY OF COAL REFUSE BANKS AND SLURRY PONDS FOR THE INDIANA STATE LEGISLATURE USING AERIAL AND ORBITAL INVENTORY TECHNIQUES

Wobber, F. J. (1), Wier, C. E. (2), Leshendok, T. (3), and Beeman, W. (4) [(1) IBM Corp., (2) Ind. Geol. Surv., (3) Earth Satellite Corp., (4) Ind. Coal Assoc.], Natl. Coal Assoc./Bitum. Coal Res., Inc., First Symp. Mine and Prep. Plant Refuse Disposal Preprints, Louisville, Ky. (1974). pp 64-77. The survey was carried out to make quickly available information on number, size, location and environmental effects of refuse disposal sites to aid the State Legislation in developing plans for reclamation of coal refuse areas. Systematic analysis of aerial color infrared photographs at 1:120,000 scale provided dependable and accurate data by which to locate and environmentally assess over 200 coal refuse sites. These data, with industry and state statistics, were used to compute a general cost of reclamation for each site. A summary of the data by county is tabulated in this paper. (Adapted from authors' abstract) D449

1975

D75-1 UTILIZATION OF COAL MINE WASTE FOR STRATA CONTROL

Allen, A. S. (U.S. Bur. Mines), Proc. First Ky. Coal Refuse Disposal and Utilization Seminar, Univ. Ky., Inst. Mining Miner. Res., IMMR9-PD7-75 (1975). pp 18-24. The Bureau of Mines has worked to develop a pumped-slurry process to reduce subsidence in the anthracite region. Dilute slurry of coal refuse is pumped through a closed injection system from a mixing tank through a pumping unit and large-diameter distribution pipeline and injection boreholes to the mine workings. (From author's abstract) D409

D75-2 COAL WASTE DISPOSAL TO ELIMINATE TAILINGS PONDS

Anderson, J. C. (U.S. Steel Corp.) Mining Congr. J. 61 (7), 42-45 (1975). Several methods of dewatering waste from coal preparation plants, as well as chemical and cementation solidification of thickener underflow, are discussed as alternatives to disposal of refuse in dams and slurry ponds. Jour

D75-3 COAL REFUSE DISPOSAL PRACTICES IN THE AMERICAN COAL INDUSTRY

Barthauer, G. L. (Consolidation Coal Co.), Proc. Polish-U.S. Symp. Environ. Protection in Openpit Coal Mining, by U.S. EPA and Cent. Res. Design Inst. Opencast Mining, Poland (POLTEGOR), Denver, Colo., May 27-29, 1975. Publ. by Univ. Denver Res. Inst., Sept. 1975. pp 29-35. NTIS, PB-249 300. The author describes the development of methods of disposal of fine refuse removed from the preparation plant water circuit and of coarse material reject. 75-30

D75-4 LOCAL PROBLEMS AND RESEARCH NEEDS FOR OPTIMUM DISPOSAL AND UTILIZATION OF COAL REFUSE

Boyd, W. T. (U.S. Bur. Mines, Ky. Liaison Office), Proc. First Ky. Coal Refuse Disposal and Utilization Seminar, Univ. Ky., Inst. Mining Miner. Res., IMMR9-PD7-75 (1975). pp 36-37. The author emphasizes the current magnitude of the waste disposal problem and the projected increase of the problem as coal mining increases in the future. Because of environmental problems from refuse stored on the surface, he urges the development of technology for reliable underground disposal. D412

D75-5 COAL WASTE BANK PARAMETERS GIVEN IN NEW USBM REPORT

Busch, R. A., Backer, R. R., and Atkins, L. A. (U.S. Bur. Mines), Coal Mining Process. 12 (7), 52-55 (1975). The authors' Bureau of Mines report, RI 7964, "Physical Property Data on Coal Waste Embankment Materials" is summarized. Jour

D75-6 PHYSICAL PROPERTY DATA ON FINE COAL REFUSE

Busch, R. A., Backer, R. R., Atkins, L. A., and Kealy, C. D. (Spokane Mining Res. Cent.), U.S. Bur. Mines, RI 8062 (1975). 40 pp. These data, developed on the fine coal waste materials that make up the core areas of two typical coal waste impoundments, will help define more completely the engineering properties of this problem area of the structures. Additional calorific, chemical, and mineralogical data were obtained on the coal waste materials to determine possible uses or development of byproducts. The possibility of extracting alumina from coal ash was also investigated. (From authors' abstract) BurM

D75-7 COAL WASTE STABILIZATION BY ENHANCED VEGETATION

Capp, J. P., Gillmore, D. W., and Simpson, D. G. (U.S. Bur. Mines), Mining Congr. J. 61 (5), 44-49 (1975). Also published in Proc. Polish-U.S. Symp.

D75-7 (continued)

Environ. Protection in Openpit Coal Mining, by U.S. EPA and Cent. Res. Design Inst. Opencast Mining, Poland (POLTEGOR), Denver, Colo., May 27-29, 1975. Publ. by Univ. Denver Res. Inst., Sept. 1975. pp 125-136. NTIS, PB-249 300. The U.S. Bureau of Mines reclamation program on the use of fly ash as a stabilizing and vegetation agent for surface mine spoil, refuse dumps and gob piles is described. The 13 test sites and the power plants providing the fly ash are identified. Analyses of fly ash for a number of major elements and several trace elements are tabulated. Some conclusions from the work are that vegetation can be established on coal waste areas with the use of fly ash; that weathering of fly ash-spoil mixture improves the success of revegetation; and that tree plantings are more effective after ground cover of grasses and legumes has been established. Costs are also discussed. Jour 75-30

D75-8 ESTIMATING THE ACID POTENTIAL OF COAL MINE REFUSE

Caruccio, F. T. (Univ. S. C.), in "The Ecology of Resource Degradation and Renewal," M. J. Chadwick and G. T. Goodman, Eds., London: Blackwell Scientific Publications, 1975. pp 197-205. Since it has been shown that fine-grained, or framboidal, pyrite is most readily decomposed to form acid, the method described here for estimating acid potential of a sample is based on determining what proportion of total pyrite is in the framboidal form. Samples are crushed, cast into plastic pellets which are polished and examined with an oil immersion lense. A calculation is made of that part of the total pyrite area of the pellet that is composed of the fine-grained form. 631. C43

D75-9 HEAT DRYING SLUDGE FROM PONDS

Casali, J. T., Mining Congr. J. 61 (1), 34-37 (1975). When the Hawley Coal Mining Corp. settling ponds were full, with no expansion possibilities, the company decided to reclaim the sludge using a Jeffrey HMV dryer and cooling vibrator unit used with non-coal materials. Twenty-three tons/hr salable material was produced using a feed material of 19% moisture. Product moisture was 7.5%. Main problems overcome in setting up the unit were in preparing and feeding material from the ponds and in controlling stack emissions. Jour

D75-10 UTILIZATION OF PENNSYLVANIA ANTHRACITE REFUSE

Charmbury, H. B. (Penn. State Univ., College Earth Miner. Sci.), Proc. First Ky. Coal Refuse Disposal and Utilization Seminar, Univ. Ky., Inst. Mining Miner. Res., IMMR9-PD7-75 (1975). pp 13-17. Most uses of anthracite refuse are in producing materials for building and construction. Refuse was also successfully used as a soilless growing medium in trials at the Floriculture Department, Pennsylvania State University. D408

D75-11 COAL MINE REFUSE DISPOSAL

W. A. Wahler and Associates Proj. Summary 325 (Jan. 1975). 4 pp. This summarizes a project in which 160 potentially hazardous coal refuse disposal sites in the Appalachian coal fields were investigated between March 1972 and December 1973. D387

D75-12 LITERATURE SURVEY - COAL ASSOCIATED WASTES (1900 - 1972)

Coalgate, J. L., W. Va. Univ., Coal Res. Bur., Rept. No. 115 (undated). (108 pp.) All wastes related to coal mining, beneficiation, and use are covered in the eleven sections of this bibliography. A total of one hundred references are listed in Section B: Utilization of Coal Mining Refuse, and in Section C: Utilization of Coal Refining and Preparation Wastes. 662.6 W521 115

D75-13 A STUDY OF COAL-ASSOCIATED WASTES RESULTING FROM THE MINING, PROCESSING AND UTILIZATION OF COAL: LITERATURE SURVEY--COAL ASSOCIATED WASTES (1900-1972)

Coalgate, J. L., W. Va. Univ., Coal Res. Bur., Interim Rept. No. 2 to U.S. ERDA, FE-1218-T-1 (Aug. 1, 1975). (120 pp.) Included in this annotated bibliography that covers the world literature are 55 references in Section B: Utilization of Coal Mining Refuse; 70 references in Section C: Utilization of Coal Refining and Preparation Wastes; and 45 references in Section D: Utilization of Shale. OCR W5 75-2

D75-14 ELASTIC-PLASTIC STABILITY ANALYSIS OF MINE-WASTE EMBANKMENTS

Corp, E. L., Schuster, R. L., and McDonald, M. M., U.S. Bur. Mines, RI 8069 (1975). 98 pp. This investigation presents a new method for analyzing the stability of mine-waste or tailings dams subjected to steady-state seepage; demonstrates the use of the technique in an actual field situation; and compares the accuracy of the method with that of conventional analysis techniques in an analysis of the Buffalo Creek Dam failure. (From authors' Introduction adapted) BurM

D75-15 INVESTIGATION OF MINING RELATED POLLUTION REDUCTION ACTIVITIES AND ECONOMIC INCENTIVES IN THE MONONGAHELA RIVER BASIN

Doyle, F. J., Chen, C. Y., Malone, R. D., and Rapp, J. R., Michael Baker, Jr., Inc., Rept. to Appalachian Regional Comm., under agreement with U.S. EPA, ARC-72-89/RPC-707 (1975). 416 pp. NTIS, PB-244 352-1WN. This study was performed to provide information on possible economically advantageous projects to abate water pollution related to mining. Pollution problems resulting from coal refuse piles are explored and the British and United States experience in dealing with them is reviewed. An inventory in Appendix A lists 333 coal refuse banks and tabulates their location, size, condition, and owner if known. Among the projects described for use of coal refuse are coal recovery, fill in highway and construction projects, and in surface mine reclamation; and manufacturing of building materials. The results of a

D75-15 (continued)

detailed laboratory investigation of the engineering properties of bituminous coal mine refuse are also included. CE21

D75-16 DESIGN AND CONSTRUCTION OF COAL REFUSE EMBANKMENTS: OCTOBER, 1975

Ellison, R. D. (E. D'Appolonia Consulting Engineers, Inc.), Natl. Coal Assoc./Bitum. Coal Res., Inc., First Symp. Underground Mining, Louisville, Ky. (Oct. 21-23, 1975). 44 pp.+ This paper discusses two examples of site optimization that are being implemented: an impounding disposal site and a non-impounding site. Site and cost data are summarized for additional facilities to illustrate that safe and environmentally sound disposal can be realized for many conditions, at reasonable cost, with proper planning, design and implementation. Finally, areas where improvements could result in lower disposal costs or better disposal procedures are identified with suggestions for future studies. (From author's Introduction) D431

D75-17 ENGINEERING AND DESIGN MANUAL: COAL REFUSE DISPOSAL FACILITIES

E. D'Appolonia Consulting Engineers, Inc., for U.S. Dept. Int., Mining Enforcement and Safety Admin., undated. (830 pp.) Available, U.S. Gov. Printing Office, Stock Number 024-019-00012-8 Price $14.65 This Manual presents procedures for use in the design of coal refuse embankments in the United States. It serves as a uniform guide to safe refuse disposal practices by providing (1) experienced embankment design engineers with the characteristics of coal refuse and its disposal; (2) specialized technical knowledge concerning embankment design to engineers who do not specialize in this field; (3) a comprehensive view of disposal requirements and limitations for operators to efficiently include refuse disposal into the overall coal production operation; and (4) suggested minimum design storms and stability factors for a range of standardized embankment classifications. Environmental control and cost of disposal are both discussed along with procedures for selecting between alternatives for a variety of site conditions. (From Preface) 631 D21

D75-18 DRY SEPARATION OF COAL FROM WASTE MATERIAL

Fairbanks, H. V., W. Va. Univ., Coal Res. Bur., Rept. No. 116 (1975). 18 pp. Studies of two separation techniques were carried out. In one, screened particles were subjected to pressure designed to crush the softer particles, mainly coal, and not the harder material. The coal was separated by screening. The second technique used an inclined vibrating feeder. Both shape and density of crushed feed affected the separation of coal from unwanted material. D419

D75-19 METHOD AND APPARATUS FOR REDUCING SULPHUR AND ASH CONTENT OF COAL

Gay, L. T. (to C-G Process Coal Co.), U.S. Pat. 3,926,787 (Dec. 16, 1975). 12 pp. This method for recovering fine coal from coal refuse uses a hydrocyclone separator. US Pat

D75-20 USEFUL MATERIALS FROM COLLIERY SPOIL

Gibson, J. (Natl. Coal Bd., U.K.), Mine and Quarry 4 (8), 24, 29-30, 33 (1975). Several uses of colliery spoil material developed in England, where natural available aggregates are in limited supply, are described. Roadway fill is the most common use, with about 10 million tons sold up to 1972. Another use is a low grade concrete made by mixtures of spoil, cement and water. This product is used for parking areas and driveway sub-bases. One application now under development uses filter cake, and other fine colliery wastes to make blocks to be used as a substitute for wood chocks underground. Spoil can also be heat-treated to give a sinter product used as a lightweight aggregate. Jour

D75-21 PROBLEMS WITH UNDERGROUND REFUSE DISPOSAL

Kegel, W. G. (Jones & Laughlin Steel Corp.), Trans. AIME 258, 280-283 (1975). General problems of handling refuse when hauling it back into the mine and of pneumatic and hydraulic stowing are discussed. Underground disposal is concluded to be the wrong method of dealing with coal refuse. Jour

D75-22 LOCAL GOVERNMENT INVOLVEMENT IN COAL REFUSE UTILIZATION: TECHNICAL MEMORANDUM

Kraus, A. (Ky. Dept. Finance Admin., Local Gov. Advisor), Proc. First Ky. Coal Refuse Disposal and Utilization Seminar, Univ. Ky., Inst. Mining Miner. Res., IMMR9-PD7-75 (1975). pp 34-35. The impact of local government on refuse disposal and utilization is achieved mainly through planning implemented by zoning regulations. D411

D75-23 MAKING MOUNTAINS IS EASY

The Consol News, Feb.-Mar. 1975. p 12. Near Moundsville, West Virginia, a coal refuse disposal site used since 1958 by Consol's Ireland Mine is being reclaimed. The project, being carried out a section at a time, includes shaping, covering, and seeding the area and controlling water runoff by diversion ditches. D385

D75-24 RECENT EUROPEAN PRACTICE IN COAL REFUSE UTILIZATION

Maneval, D. R. (Appalachian Regional Comm.), Proc. First Ky. Coal Refuse Disposal and Utilization Seminar, Univ. Ky., Inst. Mining and Miner. Res., IMMR9-PD7-75 (1975). pp 1-12. This paper discusses the occurrence, magnitude, properties, and utilization of coal mine refuse. The experience of the National Coal Board in marketing fresh and weathered refuse is highlighted. Suggestions are presented on how research and application may lead to increased acceptance and use of coal refuse. D407

D75-25 WATER BORNE POLLUTANTS FROM REFUSE PILES

Maneval, D. R. (Appalachian Reg. Comm.), Natl. Coal Assoc./Bitum. Coal Res., Inc., First Symp. Underground Mining Preprints, Vol. 2, Louisville, Ky. (1975). pp 210-219. Refuse can contribute to water pollution either through

D75-25 (continued)

leaching of refuse piles by precipitation or through inadvertent overflow of preparation plant water. Various methods of refuse handling and disposal to prevent water pollution are described. D478

D75-26 WATER QUALITY ASPECTS OF COAL REFUSE UTILIZATION

Martin, J. F., Scott, R. B., and Wilmoth, R. C. (U.S. EPA, Ind. Environ. Res. Lab., Cincinnati, Ohio), Proc. First Ky. Coal Refuse Disposal and Utilization Seminar, Univ. Ky., Inst. Mining Miner. Res., IMMR9-PD7-75 (1975). pp 25-28. An asphaltic concrete parking apron over refuse and refuse plus fly ash base courses has been installed at the Crown Mine Drainage Field Site, West Virginia. Results of monitoring the water quality of runoff showed that refuse alone contributed significant acidity, iron, and aluminum, and that refuse with fly ash and with fly ash and lime yielded only small amounts of acidity and metals. D410

D75-27 THE COAL OPERATOR'S PARTICIPATION IN COMMUNITY DEVELOPMENT

McDowell, C. D. (President, National Independent Coal Operators' Assoc.), Proc. First Ky. Coal Refuse Disposal and Utilization Seminar, Univ. Ky., Inst. Mining Miner. Res., IMMR9-PD7-75 (1975). pp 38-39. The author reviews the development of the coal industry in Kentucky and the various uses that have been investigated for coal refuse. D413

D75-28 MINIATURE DREDGE WILL RECLAIM 1,000,000 TONS OF COAL

World Coal 1 (1), 31 (1975). Peabody Coal Co.'s use of a small dredge called The Mud Cat to reclaim fine coal from a settling pond which covers about 100 acres is described. The recovered coal is pumped to a preparation plant at the rate of 40 tph and the cleaned product goes to a power plant. Jour

D75-29 MINI-DREDGE SLURPS UP TONS OF WASTE COAL FROM SLURRY SETTLING PONDS

Coal Age 80 (1), 60-62 (1975). The Mud Cat, used by Peabody Coal Company for recovering coal from slurry ponds of coal processing plants, is described. D377

D75-30 METHOD OF TREATING COAL MINING REFUSE

Minnick, L. J., Smith, C. L., Webster, W. C. (to IV Conversion Systems, Inc.), U.S. Pat. 3,870,535 (Mar. 11, 1975). 6 pp. Coal refuse containing sulfuric acid forming material is reacted with lime in the presence of moisture. The refuse can also be treated with a pozzolanically active material such as fly ash. The treatment forms a self-hardening material which may be used as a structural fill or as a road base material. Also refuse piles can be treated in the same way to form a hard impervious surface, preventing water percolation. CE50

D75-31 RECLAIMING COAL FROM SLURRY PONDS

Morris, G. H. (Peabody Coal Co.), Mining Congr. J. 61 (12), 38-40 (1975). The reclaiming methods used by Peabody Coal Co. are recovery by end loader or dragline for use without any additional preparation or for blending with raw coal fed to the preparation plant; and recovery by Mud Cat dredge of slurry to be pumped to a specially designed coal cleaning plant. Jour

D75-32 NEW PLASTER HYDROSPRAYED ONTO COAL REFUSE SMOTHERS FIRES OR AIDS REVEGETATION

Coal Age 80 (7), 137 (1975). U.S. Gypsum has developed a unique solution for revegetating burning refuse piles. A specially processed and formulated gypsum plaster is mixed with regular hydroseeding materials and sprayed on refuse piles. The process has been successful in several areas in West Virginia including a burning refuse pile. Among advantages are that a neutral pH is maintained, heat is reflected, spontaneous combustion is controlled, and it is more economical than using topsoil. D392

D75-33 COMBUSTION OF COLLIERY SHALE IN A FLUIDIZED BED

Norman, P. (Univ. Newcastle upon Tyne), Energy World No. 18, 2-4 (July 1975). In this experimental work colliery shale was dried and crushed for combustion tests in a small fluidizing reactor. The shale would not burn without some additional fuel and propane or pulverized coal was used. Bed temperatures were in the 800-900 C range. Details of air rates and supplemental fuels are given. The shale was burned out completely under these conditions. Jour

D75-34 MAKING THE GRADE IN COAL REFUSE DISPOSAL

Parker, W. W. and Gray, R. E. (GAI Consultants, Inc.), Coal Mining Process. 12 (11), 38-42, 64 (1975). The factors critical to design of stable coal refuse disposal areas are discussed. The authors point out the most serious deficiencies they have found in their review of waste disposal plans submitted for approval by MESA. Jour

D75-35 PEABODY RECLAIMS COAL FROM OLD SLURRY POND

Coal Mining Process. 12 (2), 23 (1975). See also "Peabody Recovers Waste Coal at Bee Veer Tailings Pond with Mud Cat Mining Machine," Mining Eng. 27 (2), 30 (1975). Pictured with this news note is the Mud Cat machine which is pumping slurry to the Bee Veer Mine Preparation plant in north central Missouri. Forty tons of coal/hour are being recovered and the water is returned to the impoundment. D383

D75-36 ENGINEERING PROPERTIES OF COAL WASTE EMBANKMENT MATERIAL

Peterson, R. (U.S. MESA), Natl. Coal Assoc./Bitum. Coal Res., Inc., First Symp. Underground Mining Preprints, Vol. 2, Louisville, Ky. (1975). pp 220-225. Although refuse characteristics are determined by tests used in the field of soil mechanics, the properties of refuse are different from materials commonly considered as soils. Coal refuse properties discussed in this

D75-36 (continued)

paper are gradation (amounts of various size particles), permeability, water content, consistency limits (water content that determine the liquid, plastic, or solid state of refuse), compaction and density, shear strength, and consolidation characteristics of an embankment. D479

D75-37 SPOIL HEAPS IN THE RUHR DISTRICT AND THEIR INTEGRATION INTO THE LANDSCAPE AS A MEASURE TO IMPROVE ENVIRONMENTAL CONDITIONS

Petsch, G. (Siedlungsverband Ruhrkohlenbezirk, Federal Republic of Germany), in "The Ecology of Resource Degradation and Renewal," M. J. Chadwick and G. T. Goodman, Eds., London: Blackwell Scientific Publications, 1975. pp 435-441. A summary of the condition of refuse disposal areas in the Ruhr is tabulated. Refuse disposal is controlled by government regulation, and design of disposal areas is planned so that landscaping and establishment of vegetation are being carried out while the area is being used. Coal refuse disposal areas also may be used for disposal of domestic and industrial waste. 631. C43

D75-38 PRESSURE FLUSHING SPEEDS BACKFILLING OF ABANDONED UNDERGROUND MINES

Coal Age 80 (1), 68-70 (1975). In this method, the refuse is crushed and slurried above ground. Surface pipelines then carry it to boreholes drilled into various sections of the abandoned mine. No men are required underground. The article describes a demonstration project in the Green Ridge Section of Scranton. The project is a continuation of work started in 1972 by Dowell Co. D378

D75-39 THE INFLUENCE OF PYRITE OXIDATION PRODUCTS ON THE ADSORPTION OF PHOSPHATE BY COAL-MINE WASTE

Pulford, I. D. and Duncan, H. J. (Univ. Glasgow), J. Soil Sci. 26 (1), 74-80 (1975). Coal waste materials tested to determine their ability to adsorb fertilizer phosphate showed that black shale (unburned) adsorbed more phosphate than red (burned) shale. Amorphous iron oxide, a product of pyrite oxidation, was found to be the most important factor in phosphate adsorption. Heating the refuse below 400 C increased the amount of phosphate adsorped, while heating the refuse above 400 C decreased phosphate adsorption possibly because of crystallization of the amorphous iron oxide. The refuse used in the study was taken from four sites in central Scotland. CE272

D75-40 OPENCAST AND PLANT IN THE NORTH-EAST

Read, C. P., Mine and Quarry 4 (10), 32, 35 (1975). The John Deere Co. loader JD644A handles 6 tons at a time. Its use for handling waste for coal recovery and transporting coal is described. The loader can operate on the public roads, saving the cost of extra outside equipment. Detailed specifications for the loader are included as well as descriptions of its special design features. Jour

D75-41 "THAR'S COAL IN THEM THAR TIPS ---,"

Read, C. P., Mine and Quarry 4 (9), 52-56 (1975). The use of heavy duty, high power wheeled loading shovels to recover coal from long neglected colliery waste in England's North East is described. John Deere turbo charged, four-wheel drive loading shovels handle several thousand tons/day of waste to recover usable coal. The machines are working 84 hours a week and are expected to last about four years. Removal of the piles is also an environmental asset. Jour

D75-42 PHYSICAL PROBLEMS OF GROWING PLANTS ON COLLIERY WASTE

Richardson, J. A. (Univ. Newcastle upon Tyne, U.K.), in "The Ecology of Resource Degradation and Renewal," M. J. Chadwick and G. T. Goodman, Eds., London: Blackwell Scientific Publications, 1975. pp 275-285. Particle size of refuse and its silt and clay content affect water infiltration, water holding capacity, compaction, crusting, and surface erosion of refuse piles. These characteristics and the lack of organic content in coal wastes contribute to the difficulty of establishing vegetation on the refuse. Three different aged refuse piles from similar material are compared. As weathering increased the amount of fine particles, some plant growth could occur, thus building up organic matter in the soil. The loss of fine particles by wind or storm run-off retards establishment of vegetation. Studies carried out in County Durham, England, are described. 631. C43

D75-43 APPLICATION OF PNEUMATIC STOWING IN UNITED STATES COAL MINES

Singh, M. M. (1) and Courtney, W. J. (2) [(1) Foundation Sciences, Inc. and (2) IIT Research Institute], AIME Ann. Meet., Dallas, Tex., Feb. 23-28, 1974. 32 pp. Also published as "Feasibility of pneumatic stowing in United States coal mines," Trans. AIME 258, 232-239 (1975). Standard systems of pneumatic stowing are discussed, and stowing machines described. Although Bureau of Mines studies have been conducted, there is no pneumatic stowing in U.S. coal mines and only two non-coal operations are noted. Hazards of the process are outlined. Economics of the process are included and show a cost of $1.50 to $3.00 per ton of coal mined. D343

D75-44 RECLAMATION OF ANTHRACITE COAL REFUSE USING TREATED MUNICIPAL WASTEWATER AND SLUDGE

Sopper, W. E., Kardos, L. T., and DiLisso, L. E., The Pa. State Univ., Inst. Res. Land Water Resour., Res. Proj. Tech. Completion Rept. to U.S. Dept. Int. Office Water Res. Technol., April 1975. 168 pp. NTIS, PB-243 114/6WN. The objectives of this study were to evaluate the vegetative growth responses, and chemical changes of the refuse and percolate resulting from the application of heated municipal sewage effluent and liquid digested sludge to anthracite coal processing refuse. The results of the study indicated that revegetation of anthracite coal refuse is possible through the application of treated municipal wastewater. In general, the effluent and sludge improve the chemical characteristic of the refuse and provide an abundant source of nutrients for the vegetation. (From authors' Summary and Conclusions). D434

D75-45 WASTE DAM REGULATIONS AND LABORATORY

Stanin, S. A. (U.S. MESA), Natl. Coal Assoc./Bitum. Coal Res., Inc., First Symp. Underground Mining Preprints, Vol. 2, Louisville, Ky. (1975). pp 206-209. The author discusses the development of guidelines for coal refuse disposal, and the need for data on the physical and engineering characteristics of refuse in evaluating plans for construction of refuse embankments. D477

D75-46 SUPER SIZE IMPOUNDMENT IS APPROVED

The Consol News, Feb.-Mar. 1975. p 10. An "overdesigned" impoundment and concrete spillway recently installed at Consol's Shoemaker Mine near Benwood, West Virginia is described. The spillway will handle a peak flow of 2.5 million gallons a minute. The impoundment walls are built of coal refuse material which is so compacted that water cannot penetrate it. The slurry rate into the impoundment is currently 100 gal/min. Fines are removed by froth flotation thereby reducing solids entering the impoundment. D384

D75-47 INVESTIGATION OF POTENTIAL FOR HEAT AND MATERIAL RECOVERY IN THE FLUIDIZED-BED INCINERATION OF COAL WASHERY REJECTS AND SOME OTHER INDUSTRIAL WASTES

Szpindler, G. à D. and Waters, P. L. (CSIRO Miner. Res. Labs., Australia), Proc. First International Conf. Conversion of Refuse to Energy, Montreux, Nov. 3-5, 1975. pp 313-319. This paper discusses the heat balance of the combuster and the influence of the type of bed (fluidized versus spouting) and fuel (coarse rejects, slurries, and liquid wastes) on heat recovery. Methods of controlling bed temperature, such as variations in air-fuel ratio, direct water quenching, and insertion of water-cooled tubes, and their effect on heat recovery are also discussed. Finally, the properties of the burnt rejects and their potential uses are described. (From authors' abstract) CE229

D75-48 RECLAMATION OF DERELICT LAND AT STOKE-ON-TRENT

Tandy, C. R. V. (Land Use Consultants, London, U.K.) in "The Ecology of Resource Degradation and Renewal," M. J. Chadwick and G. T. Goodman, Eds., London: Blackwell Scientific Publications, 1975. pp 421-427. Refuse piles are one of the kinds of derelict lands reclaimed to forest parks and pedestrian walkways. 631. C43

D75-49 ENGLISH AND WELSH COLLIERY SPOIL HEAPS - MINERALOGICAL AND MECHANICAL INTERRELATIONS

Taylor, R. K., Eng. Geol. 9, 39-52 (1975). Seventy-four post-failure triaxial test specimens from fifteen colliery spoil heaps in England and Wales have been chemically and mineralogically analysed. Three mineral groupings emerged from statistical correlations: clay-minerals, coal and carbonates, with the coal group showing strong inverse relationships with the clay-minerals group. Correlation matrices of physical and mechanical properties versus mineralogical and chemical components have enabled the main mineralogical controls on the physical characteristics to be recognized. Coal is

D75-49 (continued)

believed to be a major factor which influences not only peak shear strength, but fundamental properties such as natural moisture content, plastic limit and indirectly bulk density which correlates positively with the clay-minerals. (Author's abstract) D426

D75-50 TECHNOLOGICAL INNOVATIONS ABOUND IN COAL MOUNTAINS OF APPALACHIA: RECLAIMING COAL FROM REFUSE PONDS

Coal Age 80 (6), 273-274 (1975). Coal is recovered from slurry ponds at Peabody Coal Co.'s Bee Veer mine with a Mud Cat mini dredge. Jour

D75-51 UNDERGROUND DISPOSAL OF COAL MINE WASTES

Natl. Acad. Sci., Study Comm. to Assess the Feasibility of Returning Underground Coal Mine Wastes to the Mined-Out Areas, Rept. to Natl. Sci. Foundation, 1975. 172 pp. Available, Printing and Publishing Office, Natl. Acad. Sci., 2101 Constitution Ave., N.W., Washington, D.C. 20418. Although the focus of this report is on the technical and economic feasibility of coal waste disposal in mine voids, the legal parameters are considered. Differentiation is made between backfilling in active and in abandoned mines. European experience and requirements are noted. Appendixes include a glossary; a discussion of the effects of mixing and backfilling on subsidence and roof control; the basis of cost estimates; and excerpts from regulations on coal waste disposal. D389

D75-52 REGULATORY CONTROL, DESIGN APPROVAL, AND CONSTRUCTION INSPECTION OF COAL REFUSE EMBANKMENTS

Wahler, W. A. and Perry, C. W. (W. A. Wahler & Assoc.), Natl. Coal Assoc./Bitum. Coal Res., Inc., First Symp. Underground Mining Preprints, Vol. 2, Louisville, Ky. (1975). pp 227-241. The purpose of this paper is to describe the regulation of dam safety in those states where it is highly developed in order to promote the understanding of the specialized regulatory system being evolved by MESA to control the safety of coal refuse banks. D480

D75-53 PRODUCING LIGHTWEIGHT AGGREGATE

Warnke, W. E., U.S. Pat. 3,909,283 (Sept. 30, 1975). 3 pp. Coal refuse is one of the many waste products covered by this patent. Refuse material, mixed with a small amount of limestone and coal, is pelletized and fired in a rotary kiln to about 2200 F for five minutes. The carbon dioxide evolved from the limestone causes the pellets to expand. US Pat

D75-54 HYDRA-SLUDGE REMOVAL SYSTEM FOR MINE DRAINAGE AND COAL PREPARATION PLANT SLUDGE

Werner, R. H. (Barrett Haentjens and Co., Pittsburgh), AIME Ann. Meet. New York, N.Y., 1975. Preprint No. 75-F-83. 13 pp. This automatically

D75-54 (continued)

controlled commercial pumping system, which will hydraulically remove sludge materials from a settling pond or thickener, is described. 75-13

D75-55 ENGINEERING EVALUATION OF COAL REFUSE SLURRY IMPOUNDMENTS

Zook, R. L., Olup, B. J., Jr., and Pierre, J. J. (L. Robert Kimball, Consulting Engineers), AIME Ann. Meet., Dallas, Tex., Feb. 23-28, 1974. Preprint No. 74-F-39. 25 pp; Trans. AIME 258 (1), 55-61 (1975). Eight existing impoundments were studied and four dams using coarse refuse have been designed. Engineering properties of coal refuse, including grain size distribution, compaction, permeability, and shear strength; hydrologic and hydraulic analysis parameters; and site evaluations are discussed. The factors affecting the stability of dams are pointed out. D344

1976

D76-1 AERIAL TRAMWAYS EFFICIENTLY DISPOSE OF REFUSE FROM COAL PREPARATION PLANTS

Coal Age 81 (1), 167-168 (1976). Several types of tramways and their operation are described. Jour

D76-2 OPTIMIZING DISPOSAL OF COAL REFUSE AND ASH WASTES FOR A MINE-MOUTH ELECTRICAL GENERATING STATION FACILITY

Almes, R. G. (E. D'Appolonia Consulting Engineers, Inc.), Proc. Fifth Miner. Waste Utilization Symp., Chicago, Ill., by U.S. Bur. Mines and IIT Res. Inst., 1976. pp 98-106. Coal from a new mine and preparation plant will be used in the Mt. Storm Electrical Generating Station in northern West Virginia. The study to select a site for disposal of coal refuse and the final design of the disposal area are described. Both bottom ash and fly ash will also be incorporated in this area. The use of ash is expected to help control drainage through the refuse. 622 M6

D76-3 SELECTED SOIL MECHANICS PROPERTIES OF KENTUCKY COAL PREPARATION PLANT REFUSE

Bishop, C. S. and Simon, N. R. (Univ. Ky.), Proc. Second Ky. Coal Refuse Disposal and Utilization Seminar, Univ. Ky., Inst. Mining and Miner. Res., IMMR21-PD15-76 (1976). pp 61-67. The geological-mineralogical background of coal refuse is discussed. Determinations of grain size, moisture, and specific gravity were carried out on 18 refuse samples from a number of Kentucky coal preparation plants and an attempt was made to classify the refuse using criteria for soil classification systems. The California Bearing Ratio Test and analyses of shear strength were carried out to determine the engineering properties of the refuse. Results of the testing program showed that coal refuse varies greatly from plant to plant and each source of refuse should be evaluated separately to determine how it should be used. CE203

D76-4 COAL'S ULTIMATE PROBLEM CAN BE AN OPPORTUNITY

Blakely, J. W., Coal Mining Process. 13 (8), 42-45 (1976). The problem of disposing of coal mining refuse, especially the high moisture fines which tend to flow, is discussed. Some solutions to the problem lie in using engineering techniques in developing refuse disposal sites, the use of coarse refuse in construction projects, and the adaptation of high-pressure filter plates to dewatering fine refuse. Jour

D76-5 KENTUCKY COAL PREPARATION PLANT REFUSE CHARACTERIZATION AND USES

Bland, A. E., Robl, T. L., and Rose, J. G. (Univ. Ky., Inst. Mining and Miner. Res.), Proc. Second Ky. Coal Refuse Disposal and Utilization Seminar, Univ. Ky., Inst. Mining and Miner. Res., IMMR21-PD15-76 (1976). pp 21-35. Coal refuse samples from 23 of the largest coal preparation plants in Kentucky were evaluated for potential economic uses. Both current production samples and past production samples from refuse piles were evaluated. The sampling included wide geographical distribution and coal seam representation. Testing consisted of typical coal analyses, elemental analyses and slow/quick firing tests. Results showed that some refuse will make satisfactory fired clay products. Another study showed that several samples from different mine locations could be used to make satisfactory aggregate for concrete. The use of "coal-crete" material as pillars in mined-out areas was proposed. Coal pillars left as roof supports could then be recovered. (From authors' abstract) CE200

D76-6 UTILIZATION OF COAL REFUSE AS A CONCRETE AGGREGATE (COAL-CRETE)

Bryenton, D. L. and Rose, J. G. (Univ. Ky.), Proc. Fifth Miner. Waste Utilization Symp., Chicago, Ill., by U.S. Bur. Mines and IIT Res. Inst., 1976. pp 107-113. In a laboratory study, coal refuse was utilized as aggregate for producing low-cost, low-quality concrete mixes which were evaluated as roof supports to replace coal pillars. The refuse came from three preparation plants operated by Island Creek Coal Company. Refuse characteristics were found to vary significantly from one location to another. High fines or clay content made poor concrete. Modifications of the refuse by washing or by adding natural river sand improved the concrete. 622 M6

D76-7 UTILIZATION OF COAL MINE REFUSE IN HIGHWAY EMBANKMENT CONSTRUCTION

Butler, P. E. (Pa. Dept. Transportation), AIME Ann. Meet., New York, N.Y., Feb. 16-20, 1975. Preprint No. 75F81. 32 pp. Also published in Trans. AIME 260, 134-141 (1976). Since it was assumed that compacting refuse to its maximum density, i.e. to a minimum void ratio or air void percentage, would reduce the amount of oxygen available for spontaneous combustion or acid production, laboratory testing was carried out to determine refuse compaction characteristics. Refuse from the Harry E. breaker in Swoyerville, used in the Cross Valley Expressway, Luzerne County, Pa. was compared to refuse from the eastern bituminous coal field at Revloc, Cambria County, Pa. The Revloc refuse was planned to be used in another project. Methods of construction with refuse and the design and stability of embankment slopes are also discussed. AIME Jour

D76-8 UTILIZATION OF SOLID WASTE OF THE COAL INDUSTRY

Chauvin, R. and Delannoy, G. (CERCHAR), Proc. Seventh Int. Coal Prep. Congr., A. C. Partridge, Ed., Sydney, Australia, by Australian Natl. Comm., 1976. Paper L.1. 14 pp. In France, various uses of coal refuse as building and construction materials have been investigated. 662.6 I927

D76-9 COAL REFUSE INSPECTION MANUAL

U.S. Dept. Int., Mining Enforcement and Safety Admin. (MESA), April 1976. 121 pp. Available from Superintendent of Documents, U.S. Gov. Printing Office, Washington, D.C. 20402. Price $2.50. Stock No. 024-004-01879-8. This manual presents a system of classifying refuse disposal facilities as various types of non-impounding or impounding embankments. Photographs and diagrams are used liberally to illustrate the categories; conditions leading to, or resulting from, slope instability; and acceptable and unacceptable methods of handling refuse. Samples of completed inspection forms are given in the Appendix. 631 U58 1976

D76-10 CYCLONE CLEANING OF FINE COAL REFUSE

Collins, J. W. and Draeger, E. A. (McNally Pittsburg Mfg. Corp.), Proc. Second Ky. Coal Refuse Disposal and Utilization Seminar, Univ. Ky., Inst. Mining and Miner. Res., IMMR21-PD15-76 (1976). pp 97-102. The four types of cyclone cleaning described are: single stage hydrocyclone; two stage hydrocyclones; heavy media cyclone; and a combination of heavy media cyclone and hydrocyclone. Results of the four cleaning methods on feed from a Kentucky sludge pond, and from Pennsylvania and Virginia refuse piles are tabulated. CE208

D76-11 AVAILABILITY OF MINING WASTES AND THEIR POTENTIAL FOR USE AS HIGHWAY MATERIAL: VOL. I. CLASSIFICATION AND TECHNICAL AND ENVIRONMENTAL ANALYSIS; VOL. II. LOCATION OF MINING AND METALLURGICAL WASTES AND MINING INDUSTRY TRENDS; VOL. III. ANNOTATED BIBLIOGRAPHY

Collins, Robert J., Valley Forge Laboratories, Inc., Rept. to U.S. Dept. Transp., Fed. Highway Admin. (May 1976). Vol. I, with Miller, R. H., Rept. No. FHWA-RD-76-106, 308 pp. Vol. II, Rept. No. FHWA-RD-76-107, 138 pp. Vol. III, Rept. No. FHWA-RD-76-108, 47 pp. Coal refuse is one of the mining wastes covered by these volumes. In the bibliography 26 of the 80 references specifically relate to coal. 631 C71

D76-12 A METHOD FOR MEASURING THE MINERALOGICAL VARIATION OF SPOILS FROM BRITISH COLLIERIES

Collins, R. J. (Building Res. Station, Dept. Environ., U.K.), Clay Miner. 11, 31-49 (1976). This study is a part of the work toward the use of unburnt coal refuse for the production of synthetic dense aggregates. Samples from eight collieries in Great Britain were compared by x-ray diffraction analysis. Results are tabulated and discussed in detail. The most apparent

D76-12 (continued)

difference is the high kaolinite and low illite content of the Scottish spoils and the high illite and low kaolinite content of the other six spoils. CE104

D76-13 RECOVERY OF ALUMINA FROM COAL REFUSE AN ANNOTATED BIBLIOGRAPHY

Condry, L. Z., W. Va. Univ., Coal Res. Bur., Tech. Rept. No. 130 (July 1976). 8 pp. Most of the 24 references are concerned with recovering alumina from fly ash. A few cover alumina extraction from refuse or the ash from refuse. 662.6 W521

D76-14 CHOOSING CLOSED CIRCUITS FOR COAL PREPARATION PLANTS

Cooper, D. K. (U.S. Steel Corp.), Proc. Second Ky. Coal Refuse Disposal and Utilization Seminar, Univ. Ky., Inst. Mining and Miner. Res., IMMR21-PD15-76 (1976), pp 75-82. The paper describes the options explored to develop a closed water circuit for a preparation plant. The goal of the plans is to make feasible the production not only of recyclable water but also an easily handled and disposable product. A tabular comparison of the options shows that as the moisture of the dewatered solids is decreased, capital costs increase sharply. The option chosen uses vibrating drain screens and pressure filters. It produces a filter cake which can be mixed with coarse refuse for disposal without adversely affecting the structural integrity and stability of the refuse area. CE205

D76-15 UTILIZATION OF WASH WATER SLUDGE

Crossmore, E. Y. (Crossmore & Miller), Natl. Coal Assoc./Bitum. Coal Res., Inc., Second Symp. Coal Prep. Preprints, Louisville, Ky. (1976). pp 132-141. A process of making briquettes from coal preparation plant sludge is described in detail. The process steps include dewatering, deashing, and adding sodium chloride brine to act as a binder. Process economics are also presented. D468

D76-16 ARBUSCULAR MYCORRHIZAS IN THE ANTHRACITE AND BITUMINOUS COAL WASTES OF PENNSYLVANIA

Daft, M. J. and Hacskaylo, E. (U.S. Forest Serv., Beltsville, Md.), J. Appl. Ecol. 13 (2), 523-531 (1976). A study of one bituminous and two anthracite waste areas showed that the majority of plants on these areas were infected with endophytes. The leaf growth and yield of maize growing on sterile sand with bonemeal were increased by root washings from plants collected from one of the anthracite areas. Both inoculated maize and alfalfa grew in pH-adjusted anthracite waste but not in pH-adjusted bituminous waste. CE255

D76-17 MODIFYING SLOPES TO IMPROVE EMBANKMENT STABILITY

Dmytriw, S. W. (1), Mazzei, D. (2), and Wu, K. K.-K. (2) [MESA, (1) Denver Tech. Support Center and (2) Pittsburgh Tech. Support Center], Proc. Second

D76-17 (continued)

Ky. Coal Refuse Disposal and Utilization Seminar, Univ. Ky., Inst. Mining and Miner. Res., IMMR21-PD15-76 (1976). pp 37-46. Highlighted in this paper are the origin of coal refuse, an introduction to the mechanics of slope stability, general modes of failure, simplified methods of analysis, factors which affect stability and which are design considerations, and approaches which enhance stability. A significant portion of the article is written for the layman and is devoted to discussion and explanation of schematics which illustrate remedial measures and design concepts which can increase factors of safety for a typical impounding structure. (From authors' abstract). CE201

D76-18 DEEP COAL MINING: WASTE DISPOSAL TECHNOLOGY

Doyle, W. S., Park Ridge, New Jersey: Noyes Data Corporation, 1976. 392 pp. The chapters on coal refuse in this book, "Extinguishing and Removing Burning Coal Refuse Banks," and "Sealing Coal Refuse Piles," are resumes of government reports on the subjects by Andreuzzi, By LaRosa, Karnavas, and Pelczarski, and by Tyco Laboratories, Inc. 622 D75d

D76-19 COAL REFUSE IN HIGHWAY EMBANKMENTS AND AGGREGATES

Drake, W. B. (Ky. Dept. Transportation), Proc. Second Ky. Coal Refuse Disposal and Utilization Seminar, Univ. Ky., Inst. Mining and Miner. Res., IMMR21-PD15-76 (1976). pp 17-19. The feasibility of coal refuse as a highway construction material is discussed generally. CE199

D76-20 HANDLING WASTE ROCK AT WARWICK MINE

Draper, J. C. (Duquesne Light Co.), Amer. Mining Congress Coal Show, Detroit, Mich., May 10-13, 1976. Session Papers, Set No. 8. 6 pp. Removal of waste from the deep mine to the surface is by side dump or granby-type cars. The cars' contents are dumped onto a conveyor which fills a truck which is driven to the rock disposal area. Scheduling and personnel responsibility for the operation are described. 662.6 A665

D76-21 EFFECTS OF MINING SUBSIDENCE ON COLLIERY SPOIL HEAPS: I. MINING SUBSIDENCE AND GEOTECHNICAL ASPECTS OF SPOIL HEAPS AND THEIR FOUNDATIONS; II. DEFORMATIONAL BEHAVIOR OF SPOIL HEAPS DURING UNDERMINING

Forrester, D. J. and Whittaker, B. N., Int. J. Rock Mech. Min. Sci. & Geomech. Abstr. 13, I, 113-120; II, 121-133 (1976). In Section I the theoretical concepts of mining subsidence are discussed and field methods of monitoring subsidence are described. Section II gives the results of several field studies covering different conditions of refuse heaps and mining. These field observations show that refuse piles are influenced more by subsidence than was calculated by the National Coal Board Standard Subsidence prediction. The refuse areas were also found to be influenced more by subsidence than were adjacent natural areas. CE103

D76-22 EXPERIENCE IN FIELD AND LABORATORY COMPACTION TESTING OF COARSE COAL MINE WASTE

Fredland, J. W., Jr. and Sawyer, S. G. (MESA, Pittsburgh Tech. Support Cent.), Natl. Coal Assoc./Bitum. Coal Res., Inc., Second Symp. Coal Prep. Preprints, Louisville, Ky. (1976). pp 160-174. Field densities have been measured at three refuse disposal sites in western Pennsylvania: two sites contain refuse from cleaning Pittsburgh coal, while the other site has refuse from the Thick Freeport coal seam. Additionally material indexes have been determined and laboratory compaction tests have been conducted for the Thick Freeport coal refuse. This paper presents a summary of the findings of these completed field and laboratory tests. (From authors' Introduction) D471

D76-23 INVESTIGATION OF A SINTER PROCESS FOR EXTRACTION OF AL_2O_3 FROM COAL WASTES

Goodboy, K. P. (Aluminum Company of America). Met. Trans. B 7B (4), 716-718 (1976). Sulfur present in coal refuse results in different chemical reactions from those in the conventional lime sinter process. Coal waste sintered with limestone in an oxidizing atmosphere first forms calcium sulfate which then rapidly reacts to form calcium sulfoaluminate from which aluminum oxide can be extracted in a short leach time. Although excess calcium sulfate can improve aluminum extraction somewhat, it can also react with the sodium carbonate leach to produce sodium sulfate which does not leach aluminum oxide from the sintered material. CE214

D76-24 DISPOSAL OF COAL MINING INDUSTRY BY-PRODUCTS

Grube, W. E., Jr., Harris, E. F., and Martin, J. F. (U.S. EPA, Cincinnati, O.), Natl. Conf. Disposal of Residues and Land, St. Louis, Mo., Sept. 13-15, 1976. 14 pp. This general review includes information on elemental composition of coal in relation to washery wastes and mining refuse, as well as other coal mining and utilization waste products. The possibility for release of metallic elements from refuse disposal areas is discussed. CE112

D76-25 CHEMICAL STABILIZATION OF FINE COAL REFUSE WITH CALCILOX® ADDITIVE STABILIZATION TECHNIQUES

Hoffman, D. C. and Snyder, G. A. (Dravo Lime Co.), Proc. Second Ky. Coal Refuse Disposal and Utilization Seminar, Univ. Ky., Inst. Mining and Miner. Res., IMMR21-PD15-76 (1976). pp 83-88. The chemical stabilization of fine refuse by Calcilox is described, and the improved engineering properties of the stabilized refuse are shown. CE206

D76-26 GEOTECHNICAL ASPECTS OF COAL WASTE EMBANKMENTS

Holubec, I. (Geocon Ltd.), Can. Geotech. J. 13, 27-39 (1976). This paper is based on studies of West Virginia refuse banks and slurry impoundments and on a review of the North American, British and German literature on coal waste. The geologic occurrence of coal seams and related strata are

D76-26   (continued)

described to give an understanding of the components of coal refuse. The engineering properties of both coarse and fine refuse are discussed. The problems of coal refuse embankments result from physical and chemical weathering, spontaneous combustion, acid production and embankment instability caused by water seepage and flow. CE159

D76-27   SOME GEOTECHNICAL PROPERTIES OF MINERAL WASTE TAILINGS LAGOONS

Hughes, J. M. and Windles, D. (Cambridge Univ.), Ground Eng. 9 (1), 23-29 (1976). British studies of coal refuse lagoons and a lagoon used for disposal of china clay waste show that the fine and coarse materials which settle out differentially can have different properties depending on whether the materials are wet or dry, consolidated or unconsolidated. CE181

D76-28   THOSE WASTE BANKS COULD BE SOURCES FOR FUEL, ALUMINA

Kealy, D. (1), Backer, R. R. (1), Atkins, L. (1), and Busch, R. A. (2) [(1) U.S. Bur. Mines, Spokane, Wash. and (2) Gonzaga Univ.], Coal Mining Process. 13 (8), 46-49 (1976). This article reviews studies characterizing coal refuse carried out at the Spokane Mining Research Center. The information has been reported by the authors in RI 8062 "Physical property data on fine coal refuse," and an earlier publication RI 7964 "Physical property data on coal waste embankment materials." CE80

D76-29   GOB AGGREGATE CONCRETE PRODUCTS

Lawrence, W. F. and Slonaker, J. F., W. Va. Univ., Coal Res. Bur. Rept. No. 120 (Feb. 1976). 13 pp. Coal preparation plant waste material was evaluated in test cylinders and it was found that good surface bonding of the aggregate particles was achieved. Mine stopping blocks prepared by a manufacturer and tested by a commercial testing laboratory showed satisfactory compressive strengths. Coal waste material made blocks that were superior to commercial blocks in simulated fire exposure tests. However, the experimental blocks were disintegrated by weathering. CE240

D76-30   ASSESSMENT OF LATEST TECHNOLOGY IN COAL REFUSE FIRE EXTINGUISHMENT

Maneval, D. R. (Appalachian Regional Comm.), Mining Congr. J. 62 (5), 45-52 (1976). Amer. Mining Congress Coal Show, Detroit, Mich., May 10-13, 1976. Session Papers, Set No. 9. 23 pp. A number of fire control techniques are discussed and include the use of water as sprays or as slurry injections, blanketing the fire area with incombustible material, and digging out the burning bank. The hazards associated with all these methods are pointed out. Methods of constructing refuse piles to minimize burning are described. Jour

D76-31   COAL REFUSE UTILIZATION PROSPECTS--AN UPDATE OF RECENT WORK

Maneval, D. R. (Appalachian Reg. Comm.), Natl. Coal Assoc./Bitum. Coal Res., Inc., Second Symp. Coal Prep. Preprints, Louisville, Ky. (1976).

D76-31 (continued)

pp 184-198. Work reviewed includes highway projects in Pennsylvania, studies to evaluate coal refuse at the University of Kentucky, and a cooperative project to eliminate Bethlehem Mines Corporation's Revloc refuse pile in central Pennsylvania. D472

D76-32 HOW ARC HELPS LOCAL AREAS WITH ABANDONED MINE PROBLEMS - A COAL REFUSE FIRE EXAMPLE

Maneval, D. R. (Appalachian Regional Comm.), Proc. Second Ky. Coal Refuse Disposal and Utilization Seminar, Univ. Ky., Inst. Mining and Miner. Res., IMMR21-PD15-76 (1976). pp 5-12. This paper discusses the general guidelines for ARC assistance in dealing with problems from abandoned mines. Causes of coal refuse bank fires and methods of preventing and extinguishing them are described. CE198

D76-33 USE OF FLOCCULANTS AND COAGULANTS IN COAL REFUSE DEWATERING

McIntyre, G. F. and Mattix, R. D. (Nalco Chemical Co.), Proc. Second Ky. Coal Refuse Disposal and Utilization Seminar, Univ. Ky., Inst. Mining and Miner. Res., IMMR21-PD15-76 (1976). pp 93-95. This paper discusses the theory and use of flocculants and coagulants for treating refuse slurries to produce solids that can be disposed of in landfills. CE207

D76-34 THERMAL DISPOSAL OF FINE REFUSE IN A FLUIDIZED BED

Metheny, D. E. (Heyl & Patterson, Inc.), Natl. Coal Assoc./Bitum. Coal Res., Inc., Second Symp. Coal Prep. Preprints, Louisville, Ky. (1976). pp 142-151. Slurries of fine refuse from two sources were fed to an 18 inch diameter refractory lined fluidized bed pilot plant to gain experience with this method of sludge disposal. Chemical analyses of both the feed and the ash product are tabulated. Suspending the ash pellets from the pilot plant in water for extended periods resulted in only slightly increased pH of the water. D469

D76-35 MILLION-DOLLAR REFUSE DISPOSAL SYSTEM

Coal Mining Process. 13 (12), 80-82 (1976). The refuse disposal system at Cannelton Industries' Maple Meadow Mining Company near Beckley, W. Va. includes a specially prepared disposal site, belt conveyors, mine car haulage, a hard-surface haulage road, and an emergency disposal system. The system costs are tabulated. CE149

D76-36 FINE COAL DRYING

Moore, P. L., Jr. (Dresser Industries, Inc., Jeffrey Manufacturing Div.), Proc. Second Ky. Coal Refuse Disposal and Utilization Seminar, Univ. Ky., Inst. Mining and Miner. Res., IMMR21-PD15-76 (1976). pp 91-95. The fluidized-bed method described here for drying fine coal reclaimed from sludge ponds uses a modified mechanical vibrating conveyor. Hot air forced

D76-36 (continued)

through the screen openings removes moisture and then ambient air forced into the system cools the coal. CE198a

D76-37 COAL ASH AND COAL REFUSE: NEW POTENTIAL RESOURCES

Morrison, R. E. and Kinder, D. L. (Am. Electric Power Service Corp.), Proc. Second Ky. Coal Refuse Disposal and Utilization Seminar, Univ. Ky., Inst. Mining and Miner. Res., IMMR21-PD15-76 (1976). pp 69-73. This paper discusses the resource potential of the utilization of power plant ash and coal refuse. Examples are given to show how these coal by-products can be turned from a liability to an asset. (Authors' abstract) CE204

D76-38 COAL PREPARATION ENVIRONMENTAL ENGINEERING MANUAL

Nunenkamp, D. C., J. J. Davis Associates, Rept. to U.S. EPA, Ind. Environ. Res. Lab., Research Triangle Park, N.C., EPA-600/2-76-138 (May 1976). 726 pp. NTIS, PB-262 716. The manual covers the general nature and characteristics of U.S. coals, provides an overview of the coal preparation plant, discusses the major equipment and processes currently in use in coal preparation, identifies the primary waste streams found during the coal cleaning operation, discusses the techniques of control currently applied to those waste streams, and describes the contaminant removal potential of coal. (From author's abstract) 662.6 N97

D76-39 INDICATORS OF COAL REFUSE EMBANKMENT STABILITY

Parker, W. W. and Gray, R. E. (GAI Consultants, Inc.), Proc. Fifth Miner. Waste Utilization Symp., Chicago, Ill., by U.S. Bur. Mines and IIT Res. Inst., 1976. pp 86-91. Characteristics which are easily seen and which may indicate the instability of refuse banks include cracks or irregularities in profile of crest or slope, erosion, seepage or piping (erosion of fine materials from the interior of the embankment), poor condition of hydraulic control facilities, steep slope angles, and the attitude of trees or tall vegetation on the slopes. With the help of these visual indicators, General Analytics, Inc. personnel inspected 179 coal refuse disposal sites from 1972 to 1975. Construction and operation of refuse disposal areas were also observed and methods contributing to unstable conditions are discussed. 622 M6

D76-40 BURNT COLLIERY SHALE AS A PLANT GROWTH MEDIUM

Pulford, I. D. and Duncan, H. J. (Glasgow Univ.), Surveyor 147 (4385), 27 (25 June, 1976). An advantage of burnt refuse is that it does not weather to produce acid. The plant availability of metals was greatest in refuse heated to about 450 C and decreased at higher temperatures, in some cases, even below levels found in unburnt refuse. Addition of organic material or fertilizer may be necessary for establishing vegetation on refuse. CE106

D76-41 KENTUCKY COAL REFUSE: A GEOCHEMICAL ASSESSMENT OF ITS POTENTIAL AS A METALS SOURCE

Robl, T. L., Bland, A. E., and Rose, J. G. (Univ. Ky., Inst. Mining Miner. Res.), Natl. Coal Assoc./Bitum. Coal Res., Inc., Second Symp. Coal Prep. Preprints, Louisville, Ky. (1976). pp 152-159. Coal refuse samples were taken from 23 of the largest coal preparation plants in Kentucky, located in both the eastern and western coal basins. Total sulfur, Btu, and ash contents were determined for the bulk material. Complete major and selected minor and trace elements analyses were performed on the ash fractions of the material. The refuse from the eastern coal field contained more Al_2O_3, TiO_2, and less CaO and Fe_2O_3 in the ash and less bulk sulfur than the refuse from the western field. The Hazard No. 4 coal seam was found to produce a refuse with an Al_2O_3 content of 33 to 38 percent; the range for the other eastern coal seams was 22 to 27 percent. The concentration of zinc was found to be about three times greater in the western coal field than in the eastern. As much as 0.1 percent zinc was found in refuse from the No. 11 seam. (From authors' abstract) D470

D76-42 COMPOSITION AND PROPERTIES OF REFUSE FROM KENTUCKY COAL PREPARATION PLANTS

Rose, J. G., Robl, T. L., and Bland, A. E. (Univ. Ky.), Proc. Fifth Miner. Waste Utilization Symp., Chicago, Ill., by U.S. Bur. Mines and IIT Res. Inst., 1976. pp 123-131. Samples from 23 of the largest coal preparation plants in Kentucky represented a wide geographical area, a large number of coal seams and both current and past production. Testing consisted of typical coal analyses, elemental analyses, and slow/quick firing tests. Results indicate that some of the refuse will make satisfactory fired clay products and some showed promise as expanded lightweight aggregate. Ash, Btu and sulfur contents were found to vary over a wide range, reflecting different processing techniques and geological environments. Eastern Kentucky samples contained relatively high Al_2O_3 and western Kentucky samples contained high Fe_2O_3, CaO, P_2O_5 and sulfur. Characteristics were quite similar within a seam or between old and new refuse. Variations were significant from one seam to another. (Authors' abstract adapted) 622 M6

D76-43 FLY ASH GROUT SNUFFS STUBBORN COAL REFUSE FIRE

Ryan, C. P. (Engineered Construction International, Inc.), Electric Light and Power 54 (6), 27-28 (1976). A long-burning refuse pile near an Ohio Edison generating plant was extinguished by slurried fly ash injected through pipes driven into the burning zone. The method, developed by the Bureau of Mines before 1960, is described in detail. CE180

D76-44 MINE REFUSE IMPOUNDMENTS IN THE UNITED STATES

Schlick, D. P. (1) and Wahler, W. A. (2) [(1) U.S. Dept. Int., MESA and (2) W. A. Wahler and Associates], U.S. Dept. Int., Mining Enforcement and Safety Admin., IR 1028 (1976). 39 pp. This paper describes the development of various types of refuse embankments, including coal refuse, and surveys the factors influencing their effectiveness, efficiency, economy,

D76-44 (continued)

safety, environmental suitability and proper use of resources. The present state-of-the-art in the United States and South America and the present programs for the development of improved technology and regulatory control are described. Waste material and structure types, and state or condition characteristics and classification systems are also presented. (From authors' abstract) D425

D76-45 MINE WASTE EMBANKMENTS NEED SAME ENGINEERING ATTENTION AS EARTHFILL DAMS

Singh, M. M., Coal Age 81 (5), 112-116 (1976). In this discussion of design to counteract characteristics causing instability in mine waste embankments and dams for settling ponds, the Aberfan and Buffalo Creek disasters are cited as examples of problems that can be encountered. Jour

D76-46 RECLAMATION OF A BURNED ANTHRACITE REFUSE BANK WITH MUNICIPAL SLUDGE

Sopper, W. E., Kardos, L. T., and Edgerton, B. R. (The Pa. State Univ.), Compost Sci. 17 (2), 12-19 (1976). The study was carried out in Scranton, Pa. at the Cedar Ave. refuse bank which had been graded after a fire in the refuse and underlying mine was extinguished in the period from 1966-70. Three experimental plots, divided into four subplots each, were treated with 0, 18, 34, and 66 dry tons per acre of sewage sludge and planted with ten species of trees, five species of grasses, and five species of legumes. Generally, growth was best on the plots treated with 34 tons of sludge per acre; grasses were better suited than legumes to revegetating refuse; and hardwood species grew better than conifers, particularly where herbaceous cover was used with tree planting. CE178

D76-47 INFLUENCE OF COAL WASTE DISPOSAL REGULATIONS

Stanin, S. A. (U.S. Mining Enforcement Safety Admin.), Amer. Mining Congress Coal Show, Detroit, Mich., May 10-13, 1976. Session Papers, Set No. 9. 8 pp. The reactions to coal waste disposal regulations by various groups are discussed. 662.6 A665

D76-48 SURFACE SUBSIDENCE CONTROL IN MINING REGIONS

Final Environmental Impact Statement, Bur. Mines, U.S. Dept. Int., FES 76-58 (Nov. 5, 1976). (163 pp.) The Bureau of Mine's ongoing program in backfilling abandoned mines to control subsidence is described in detail. Coal refuse is one of the materials which has been used to fill mine voids. 631 U29s

D76-49 SURVEY OF MINING REFUSE USES IN NORTHEASTERN PENNSYLVANIA

Urban Services Group, Inc., Final Draft Rept. to the Economic Development Council of Northeastern Pa., Dec. 20, 1976. 45 pp.+ This survey discusses both reclamation of anthracite refuse bank areas by increasing the use of

D76-49 (continued)

refuse material and reclamation of orphaned surface-mined land. Governmental support, private investment, and reestablishing Anthracite Research Institute are suggested as means of carrying out the restoration of the area. CE260

D76-50 SYNTHETIC PIPE MAKES HIGH MARKS WITH PEABODY COAL

Coal Mining Process. 13 (8), 57 (1976). Peabody Coal Company's experience with high density polyethylene pipe in carrying slurry from several coal preparation plants to the various disposal areas is described. CE80b

1977

D77-1 COAL REFUSE DISPOSAL

Akers, D. J., W. Va. Univ., Coal Res. Bur., Rept. No. 137, 11 pp. Presented, 52nd Ann. Meet., W. Va. Acad. Sci., Salem College, Salem, W. Va., April 1-2, 1977. This paper discusses the important factors in site evaluation and refuse pile design and construction that must be considered for prevention of fires in refuse piles and for control of water pollution. Criteria for slurry impoundments are also discussed and impoundment design information required by MESA is listed. 662.6 W521 137

D77-2 DIRT ABSORBING HEADING AT WHITWICK COLLIERY

Ash, J. W., The Mining Eng. 136 (194), 591-598 (1977). This article describes a mining system which can extract coal from a thin seam and in an integrated operation dispose of the mining dirt in an adjacent area. CE357

D77-3 PHYSICAL PROPERTIES OF WESTERN COAL WASTE MATERIALS

Backer, R. R., Busch, R. A., and Atkins, L. A., U.S. Bur. Mines, RI 8216 (1977). 29 pp. This study was carried out mainly at two sites, one in northeastern New Mexico and one in central Utah, where preparation operations were similar to practices in the eastern coal regions. Results of chemical and physical analyses of both coarse and fine refuse are tabulated. New concepts relating statistical shear strength data to liquifaction potential are presented. The data indicate that western coal sludge is coarser with higher permeabilities and shear strength than eastern deposits. (Adapted from authors' Conclusions and abstract) BurM

D77-4 ECONOMIC EVALUATION OF COAL REFUSE DISPOSAL SYSTEMS

Brown, R. E. (1), Wilson, T. C. (2), and Thomasson, D. L. (1) [(1) Law Engineering Testing Co. and (2) Amer. Elec. Power Service Corp. Fuel Supply], Natl. Coal Assoc./Bitum. Coal Res., Inc., Third Symp. Coal Prep. Preprints, Louisville, Ky. (1977). pp 141-151. Three refuse disposal methods are compared. In the first, fine refuse is mechanically dewatered at the preparation plant, dewatered fines are mixed with coarse refuse and

D77-4 (continued)

the combination transported to the refuse pile. In another method, sediment is removed from a slurry settling pond with drag line, transported with coarse refuse, and dumped into pits excavated in the disposal area. In the third method, fine refuse slurry is pumped behind a dam constructed simultaneously with coarse refuse. D473

D77-5 AN ALTERNATE MEANS OF TRANSPORTING COAL OR WASTE ROCK

Carstens, M. R. (1) and Leva, D. W. (2) [(1) Geo. Inst. Tech. and (2) Tubexpress Systems, Inc.], Natl. Coal Assoc./Bitum. Coal Res., Inc., Third Symp. Underground Mining Preprints, Louisville, Ky. (1977). pp 86-98. The system described uses large-diameter pneumatic capsule pipelines. D481

D77-6 CONSTRUCTION GUIDELINES FOR POLLUTION CONTROL FROM COAL REFUSE PILES AND SLURRY PONDS

Connell, J. P. (W. A. Wahler & Assoc.), Natl. Coal Assoc./Bitum. Coal Res., Inc., Third Symp. Coal Prep. Preprints, Louisville, Ky. (1977). pp 164-167. In carrying out the project to develop guidelines, eight active refuse piles and six slurry ponds were studied. Construction guidelines for refuse pile pollution control include layering and compaction, methods of drainage control, and preparing completed disposal areas for establishment of vegetation. Guidelines for slurry pond operation include recycling water where possible, or treating before returning to ground or surface waters, maximizing retention time to allow settling of solids, discharging slurry into the pond at a minimum velocity, and removing clear water from near the top of the pond. D475

D77-7 ELECTRICITY SOLIDIFIES SLIME MINE WASTE

Coal Age 82 (3), 109 (1977). The electrolytic process which is described has been used successfully by the Bureau of Mines Spokane Mining Research Center on slimes from metal mining, and has shown promise in use with coal fines. Jour

D77-8 DAMS AND MINE WASTE STRUCTURES, AN EXAMINATION OUTLINE

Harner, R. E. (Travelers Insurance Co.), Professional Safety 22 (1), 20-24 (1977). Different types of structures, their design and construction, and conditions indicating possible failure are described. A Glossary concludes the article. CE296

D77-9 DISPOSAL OF COAL REFUSE SLURRY UNDERGROUND

Jankousky, C. K. (Freeman United Coal Mining Co.), Mining Congr. J. 63 (9), 68-71 (1977). Several years experience in pumping slurry from the coal preparation plant into an abandoned section of the Illinois Company's Orient #4 mine is described. Both slurry injection and water recovery boreholes were drilled. Recovered water returns to the lake that is the source of water for the preparation plant. Average values for various

D77-9 (continued)

parameters of water quality are listed and the author notes that recycling is adding to the corrosiveness of the water supply. Other disadvantages of underground disposal are the possibility of methane traveling back through the pipeline to the pump when the pump is off; and the inconvenience of carrying out maintenance on submersible pumps. The cost of disposing all refuse underground at this mine was estimated to be greater than the cost of surface disposal in areas enclosed in earthfill dams. Jour

D77-10 DEWATERING TAILINGS AND COAL FINES BY CENTRIFUGATION

Keith, F. W., Jr., Moll, R. T., and O'Donnell, C. (Pennwalt Corp., Sharples-Stokes Div.), Natl. Coal Assoc./Bitum. Coal Res., Inc., Fourth Symp. Coal Utilization Preprints, Louisville, Ky. (1977). pp 137-145. Dewatering refuse and fine coal by use of a solid bowl horizontal conveyer type of centrifuge is described. Because more abrasive-resistant materials are now available, higher centrifugal force can now be used and dewatering will be improved. Performance data are given for western refuse and for three eastern refuse materials, at various feed rates and with and without polymer addition. D482

D77-11 IMPACT OF GOB AND POWER-PLANT ASH DISPOSAL ON GROUND WATER QUALITY AND ITS CONTROL

Libicki, J. (Cent. Res. Design Inst. Opencast Mining, Wroclaw, Poland), Natl. Coal Assoc./Bitum. Coal Res., Inc., Third Symp. Coal Prep. Preprints, Louisville, Ky. (1977). pp 185-204. Two sites for disposal of coal mining and preparation wastes and of coal ashes and slag from power plants were monitored. Increases in the content of a number of ions in the ground water are reported. Recommendations are made for classification of disposal areas, for testing refuse materials, and for monitoring ground water in order to protect aquifers from pollution. D476

D77-12 RECENT DEVELOPMENTS IN REPROCESSING OF REFUSE FOR A SECOND YIELD OF COAL

Maneval, D. R. (Appalachian Reg. Comm.), Natl. Coal Assoc./Bitum. Coal Res., Inc., Third Symp. Coal Prep. Preprints, Louisville, Ky. (1977). pp 152-162. The author reviews seventeen projects for the reclamation of coal from refuse. The operations were carried out both in the United States, particularly Pennsylvania, and in Europe. D474

D77-13 MECHANISED PACKING FOR LONGWALL FACES

Mine and Quarry 6 (12), 12, 14-15, 17-18 (1977). The packing of the gate-side both with refuse from the mining operation and with materials brought into the mine is discussed. Jour

D77-14 ILLINOIS LANDS AFFECTED BY UNDERGROUND MINING FOR COAL

Nawrot, J. R., Haynes, R. J., Pursell, P. L., D'Antuono, J. R.,

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Sullivan, R. L., and Klimstra, W. D., Southern Ill. Univ., Cooperative Wildlife Res. Lab., Rept. to Ill. Inst. Environ. Qual., March 1977. 195 pp. Both abandoned and active mines were inventoried and the findings are summarized. Refuse piles and slurry impoundments and drainage from these areas are included in mining conditions identified as affecting land. Descriptions of the refuse areas include the types and amounts of vegetation growing on them. CE302

D77-15 SKY EYE MONITORS TAILINGS DAMS

Roth, L. H., Cesare, J. A., and Allison, G. S. (CH2M HILL), Coal Age 82 (8), 58-62 (1977). A method of measuring refuse bank movements that can precede embankment failure was developed for the Bureau of Mines. Eleven-inch diameter discs painted white and mounted on galvanized pipe are used as target and control points for aerotriangulation and regular interval photography. Analyses of the photographs show movements of the discs indicating slope movement, cracks, erosion, and downslope creep. Jour

D77-16 COAL SILT CONTROL IN PENNSYLVANIA

Siebert, C. L., Jr. (Pa. Dept. Environ. Resour., Ind. Wastes Div.), Water Pollut. Contr. Assoc. Pa. Mag. 10 (1), 8-13 (Jan.-Feb. 1977). The author describes the effects of coal washery water on the rivers and streams of the anthracite region of Pennsylvania before water pollution control was practiced. Visible improvements resulted from methods of clarifying waste water developed in response to legislation. D495

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